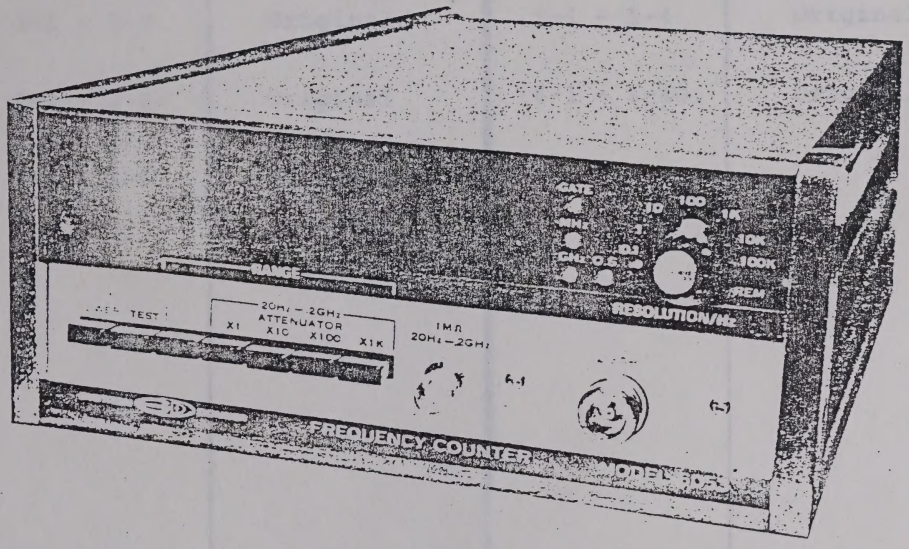
Concord Instrument Division

INSTRUCTION MANUAL



CONCORD INSTRUMENT
DIVISION
MODEL 6053/3
FREQUENCY COUNTER

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SYSTRON DONNER CORPORATION

888 Galindo Street, Concord, California 94520, U.S.A.
Tel: (415) 682-6161, TWX: 910-481-9478, Cable: SYSTRONDONNER

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CHAPTER 1
GENERAL INFORMATION

1.1 INTRODUCTION

The SD Model 6053/3 is a portable, half-rack, microwave counter capable of automatically measuring signal frequencies ranging from 20Hz to 3GHz. Extensive use of integrated circuits and other solid-state components ensures excellent reliability and trouble-free maintenance.

The Model 6053/3 microwave counter provides the following operating features:

1. An easily read storage-type display which permits the initial reading to be observed while another is being made.
2. Direct reading of frequency with no front panel adjustment necessary.
3. Automatic units of measure and decimal point location.
4. Completely remote programmable: programming inputs for all front panel controls and attenuator switch (optional).
5. BCD recorder output (optional).
6. Unit can be operated on either 115V or 230V ac line.

1.2 FUNCTIONAL DESCRIPTION

The Model 6053/3 features the Automatic Computing Transfer Oscillator (ACTO®) technique in conjunction with a new high-sensitivity, high input impedance .2GHz amplifier to offer unparalleled performance. The basic seven-digit instrument receives its input on one of two input connectors.

1. BNC - This 20Hz to .2GHz input channel features 10mV rms sensitivity and one megohm impedance. Input signals may be attenuated by factors from 1 to 1000, in decade steps.
2. "N" type connector - Frequencies from .2GHz to 3GHz can be measured with sensitivities of 50mV rms into 50 ohms.

1.3 SPECIFICATIONS

Table 1.1 lists the specifications applicable to the Model 6053/3:

TABLE 1.1 SPECIFICATIONS

Low-Frequency Range Input	Frequency Range:	20Hz to .2GHz.
	Type of Signal:	CW.
	Sensitivity:	10mV rms.

TABLE 1.1 SPECIFICATIONS (Cont'd)

	Maximum Input Without Damage:	600V dc, 200V rms.
	Input Impedance:	1MΩ.
	Input Connector:	Type BNC.
	Accuracy:	±1 count ±time base accuracy.
	Resolution:	100kHz to 0.1Hz in decade steps.
	Reads In:	MHz or GHz.
High-Frequency Range Input	Frequency Range:	.[illegible]MHz to 3GHz.
	Type of Signal:	CW.
	Sensitivity:	50mV rms (-7 dBm).
	Maximum Input Without Damage:	2.33V rms (+20 dBm).
	Maximum Usable Input:	500mV rms (+7 dBm).
	Input Impedance:	50Ω nominal.
	Input Connector:	Type N.
	Accuracy:	±1 count ±time base accuracy.
	Resolution:	100kHz to 0.1Hz in decade steps.
	Reads In:	MHz or GHz.
	Acquisition Time:	200ms typical.
	FM Tolerance:	Maximum of 0.1% deviation at modulation frequency of 60Hz. Permissible deviation is reduced 50% for each increasing octave of modulation frequency.
	Maximum Amplitude Modulation:	70% (400Hz to 1kHz).

Maximum Input Without Damage:	600V dc, 300V rms.
Input Impedance:	1MΩ.
Input Connector:	Type BNC.
Accuracy:	+1 count plus base accuracy.
Resolution:	100kHz to 0.1Hz in decade steps.
Reads In:	MHz or CPM.
Type of Signal:	CW.
Sensitivity:	50mV rms (-7 dBm).
Maximum Input Without Damage:	1.13V rms (+20 dBm).
Maximum Usable Input:	500mV rms (-1 dBm).
Input Impedance:	50Ω nominal.
Input Connector:	Type N.
Accuracy:	+1 count plus base accuracy.
Resolution:	100kHz to 0.1Hz in decade steps.
Reads In:	MHz or CPM.
Acquisition Time:	200ms typical.
3% Tolerance:	Maximum of 0.1% deviation at modulation frequency of 60Hz. Percentage deviation is reduced 30% for each increasing octave of modulation frequency.
Maximum Amplitude Modulation:	70% (400Hz to 1kHz).

TABLE 1.1 SPECIFICATIONS (Cont'd)

	Lock-On Range:	Approximately 5% of input frequency.
Time Base	Crystal Frequency:	1MHz.
	Stability:	±2 parts in 10^6/month.
	Temperature:	Less than ±1 part in 10^7 from +15°C to +35°C; less than ±3 parts in 10^7 from 0°C to +50°C.
	Line Voltage:	Less than ±1 part in 10^7 for 10% change in line voltage specified.
	Output Frequency:	1MHz, 3V p-p minimum open circuit; source impedance 2000Ω maximum.
	External Input:	1MHz sinewave, 1V rms into 1000Ω, 10V rms maximum.
	Higher Stability Available:	See options listed.
General	Registration:	7 digits, expandable to 9.
	Reads In:	MHz or GHz with positioned decimal point.
	Display Storage:	Provides a continuous display of most recent measurement.
	Rear Panel:	1MHz internal/external switch, BNC connector for 1MHz input or output, line cord, oscillator adjustment, fuse.
	Operating Temperature:	0°C to +50°C.
	Dimensions:	3-1/2" high x 8-3/8" wide x 13" deep.
	Weight:	10 lbs. net (15 lbs. shipping.
	Power:	115V/230Vac, 50 to 60Hz.

TABLE 1.1 SPECIFICATIONS (Cont'd)

Options	B3	Aging Rate: <±3 parts in 10^8/24 hours. Long-Term Aging Rate: ±3 parts in 10^8/30 days. Short-Term Aging Rate: ±1 part in 10^{10} rms/1s average.
	B	Aging Rate: <±1 part in 10^9/24 hours. Long-Term Aging Rate: ±3 parts in 10^8/30 days. Short-Term Aging Rate: ±1 part in 10^{10} rms/1s average.
	B4	Aging Rate: <±5 parts in 10^{10}/24 hours. Long-Term Aging Rate: ±1.5 parts in 10^8/30 days. Short-Term Aging Rate: ±5 parts in 10^{11}/1s average.
	E & EE	Additional decade indicator to increase count capacity to 8 (E) or 9 (EE) digits.
	D3	1-2-4-8 BCD Output: Coded output information of front panel reading appears at rear panel connector. Positive logic "1" state level at +5V nominal, "0" state level at 0V ±0.5V; a +5V print command at the end of each conversion, positive reference level is +4V, negative reference level is +1V with a column capacity equal to the number of digits.
	P	Remote programming of range, resolution and attenuators. T^2L, DTL compatible.

CHAPTER 2
INSTALLATION

2.1 INTRODUCTION

Procedures for inspection and initial installation of SD Model 6053/3 are outlined below. Reshipment instructions have been included should the instrument require return to Systron-Donner Corporation.

2.2 RECEIVING INSPECTION

Before accepting the instrument from the shipper, inspect the shipping container for signs of external damage. Any sign of such damage must be noted by both the shipper and customer; then, should be reported to the insurance investigator.

As soon as the instrument is unpacked, inspect it for shipping damage. Check for scratches or dents, broken or cracked knobs, and damaged connectors. Should any damage be found, notify your nearest Systron-Donner representative -- do not use the instrument until instructed to do so by the representative.

2.3 INSTALLATION

Initial installation of the Model 6053/3 includes power connection and verification of internal cooling.

2.3.1 Power

The Model 6053/3 may be operated from a 115 or 230-volt ac (±10%) power source. Conversion from one source to another is performed by changing jumpers on the power transformer (See Figure 2.1).

The instrument is factory-supplied with a 1A, 3AG fuse for 115V operation. Be sure to replace this fuse with a .5A, 3AG fuse when operating with 230V.

CAUTION

Before connecting instrument into ac power line, be certain that transformer is wired for proper power.

The Model 6053/3 is equipped with a standard three-conductor power cord that automatically grounds the unit when a matching power outlet is available. An adapter which provides the instrument ground should be used whenever the power cord is connected to a two-conductor outlet.

2.2.2 Cooling

The Model 6053/3 Counter uses forced air cooling. The air intake is located on the rear panel of the instrument. Make sure the air intake filter is clean and in place before applying power to the instrument. Under no circumstances should the air intake be obstructed while the instrument is operating.

2.4 RESHIPMENT

Should it become necessary to reship the instrument, contact the nearest Systron-Donner field office for shipping instructions. If possible, use the original packaging materials, or replace the packing in accordance with MIL-P-116 and MIL-E-17555E. The field office can provide materials similar to those used for original factory packaging. All correspondence should refer to the full nomenclature and serial number of the instrument.

BOTTOM VIEW OF INSTRUMENT

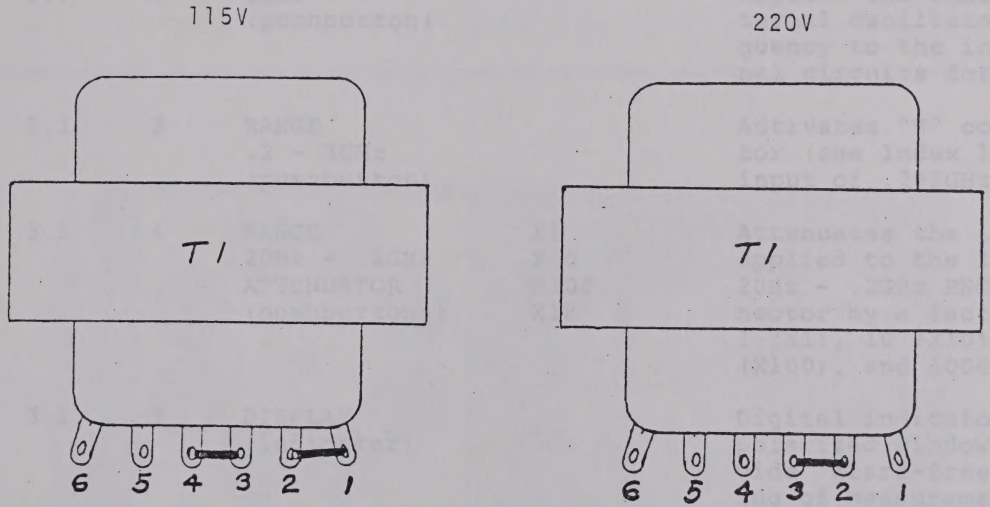
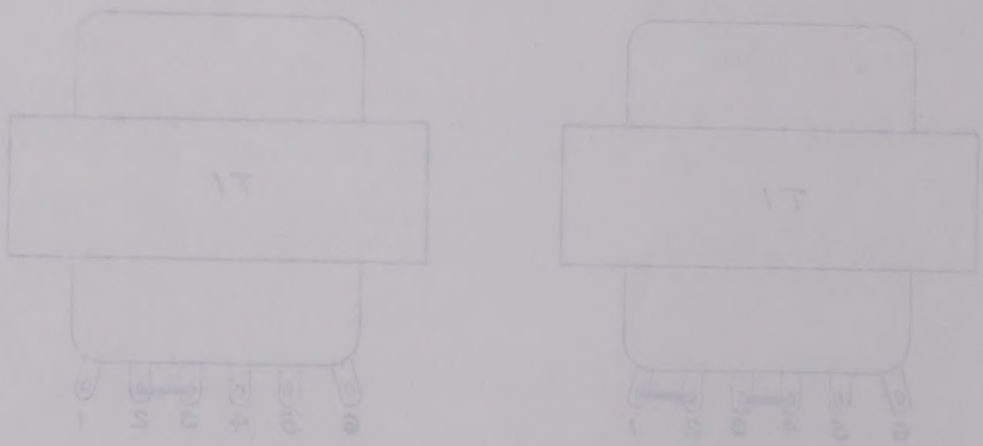


FIGURE 2.1 TRANSFORMER JUMPER POSITION FOR POWER CHANGE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T1

CHAPTER 3
OPERATION

3.1 INTRODUCTION

This section describes the SD Model 6053/3 controls, connectors, and indicators. Initial turn-on and operational checks are included, along with step-by-step operating procedures listing each basic function of the counter.

3.2 CONTROLS, CONNECTORS, AND INDICATORS

Figures 3.1 and 3.2 illustrate the Model 6053/3 front and rear panel controls, connectors, and indicators. Table 3.1 and 3.2 provide a description of these functions.

TABLE 3.1 FRONT PANEL

FIGURE	INDEX	NAME		FUNCTIONS
3.1	1	POWER (pushbutton)		Applies power to the instrument.
3.1	2	TEST (pushbutton)		Applies the 1MHz internal oscillator frequency to the internal circuits for test.
3.1	3	RANGE .2 - 3GHz (pushbutton)		Activates "N" connector (see Index 11) for input of .2-3GHz.
3.1	4	RANGE 20Hz - .2GHz ATTENUATOR (pushbuttons)	X1 X10 X100 X1k	Attenuates the input applied to the 1MΩ, 20Hz - .2GHz BNC connector by a factor of 1 (X1), 10 (X10), 100 (X100), and 1000 (X1k).
3.1	5	DISPLAY (indicator)		Digital indicators and polarized window provide glare-free viewing of measurement.
3.1	6	20Hz - .2GHz 1MΩ (connector)		Type BNC provides signal input connection for the 20Hz - .2GHz range of measurement.

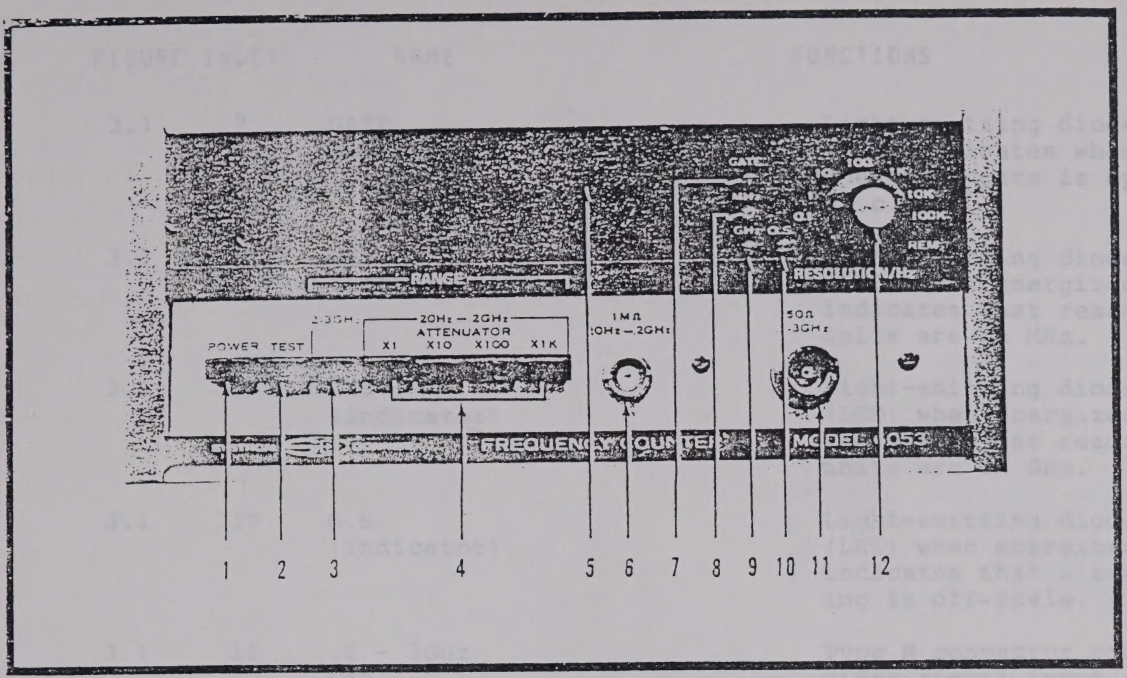


FIGURE 3.1 FRONT PANEL, MODEL 6053/3

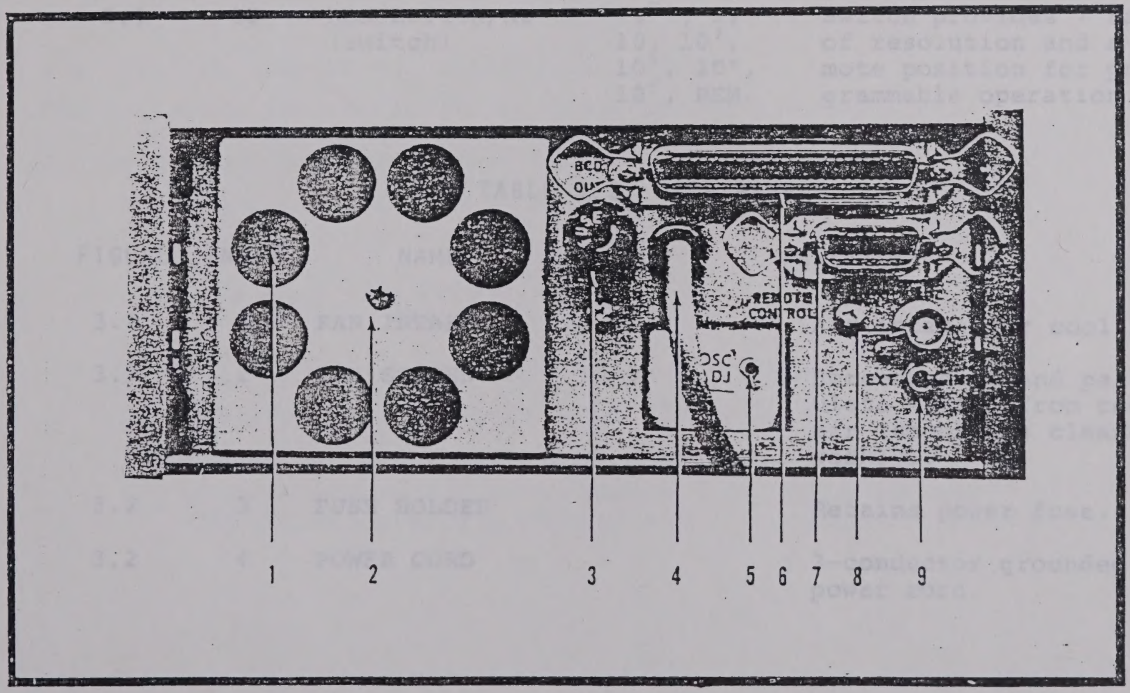


FIGURE 3.2 REAR PANEL, MODEL 6053/3

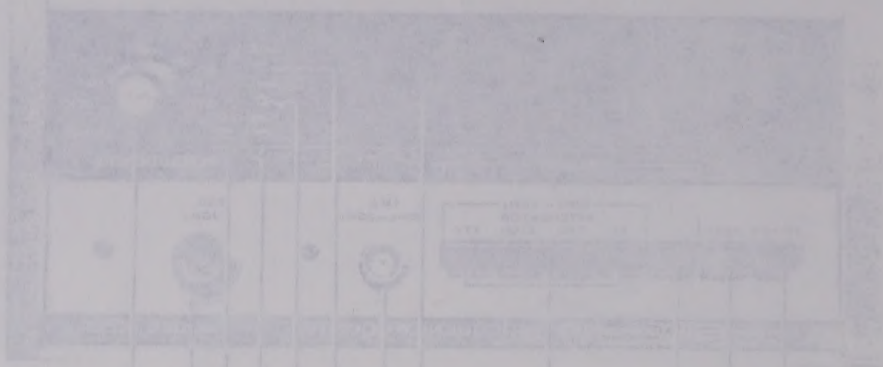


TABLE 3.1 FRONT PANEL (Cont'd)

FIGURE	INDEX	NAME		FUNCTIONS
3.1	7	GATE (indicator)		Light-emitting diode (LED) indicates when the count gate is open or closed.
3.1	8	MHz (indicator)		Light-emitting diode (LED) when energized, indicates that readout units are in MHz.
3.1	9	GHz (indicator)		Light-emitting diode (LED) when energized, indicates that readout units are in GHz.
3.1	10	O.S. (indicator)		Light-emitting diode (LED) when energized, indicates that a reading is off-scale.
3.1	11	.2 - 3GHz 50Ω (connector)		Type N connector provides signal input connection for .2 - 3GHz.
3.1	12	RESOLUTION/Hz (switch)	10^{-1}, 1, 10, 10^{2}, 10^{3}, 10^{4}, 10^{5}, REM.	Switch provides 7 ranges of resolution and a remote position for programmable operation.

TABLE 3.2 REAR PANEL

FIGURE	INDEX	NAME	FUNCTION
3.2	1	FAN INTAKE	Air intake for cooling.
3.2	2	FAN SCREEN	Screens dust and particulate matter from cooling air (should be cleaned weekly).
3.2	3	FUSE HOLDER	Retains power fuse.
3.2	4	POWER CORD	3-conductor grounded power cord.

TABLE 3.2 REAR PANEL (Cont'd)

FIGURE	INDEX	NAME		FUNCTION
3.2	5	1MHz OSCILLATOR (controls)	Coarse Fine	Adjusts the internal 1MHz oscillator frequency.
3.2	6	BCD OUT (optional connector)		Provides BCD information compatible with IC logic.
3.2	7	REMOTE CONTROL (optional connector)		Permits remote operation of attenuator and all front panel controls.
3.2	8	1MHz (connector)		Provides 1MHz out when INT/EXT switch is in INT position. Provides input for external 1MHz signal when INT/EXT switch is in EXT position.
3.2	9	INT/EXT (switch)		Provides selection of internal or external time base.

3.3 INITIAL TURN-ON AND OPERATIONAL CHECK

The following procedures verify operation of the Model 6053/3 prior to on-line usage. Successful completion of these checks should precede any performance tests.

1. Connect power cord to 115V ac source.

CAUTION

Be sure transformer is wired for 115V operation (see Section 2.3.1).

2. Position INT/EXT switch (Index 9, Figure 3.2) to INT.
3. Press POWER pushbutton to ON (Index 1, Figure 3.1).
4. Press TEST pushbutton to ON (Index 2, Figure 3.1).
5. Check instrument readout (Table 3.3) while turning RESOLUTION/Hz switch through the (7) selectable ranges.

TABLE 3 3 CHECK, IN TEST

RESOLUTION/Hz SWITCH POSITION	READOUT INDICATION
10^{-}	XX.0000000 MHz (O.S.)
1	XX1.000000 MHz
10	XX01.00000 MHz
10^{2}	XX001.0000 MHz
10^{3}	XX0.001000 GHz
10^{4}	XX00.00100 GHz
10^{5}	XX000.0010 GHz
REMOTE	Same as above

XX - Additional digits available, E and EE Options

3.4 OPERATING PROCEDURES

The following procedures outline the general method for operating the Model 6053/3 in the two measurement ranges.

3.4.1 General

Operation is fully automatic and requires no special adjustments.

3.4.2 20Hz - .2GHz RANGE

1) Press POWER pushbutton to ON.
2) Press proper attenuator pushbutton in accordance with input level. If input level is unknown, select highest attenuation level (X1k) first; then, proceed to select lower attenuation levels (X100, X10, or X1) to obtain consistent count readings.
3) Apply 20Hz - .2GHz signal to 1MΩ Type BNC connector.
4) Select desired readout resolution.
5) Measurement is automatic.

3.4.3 2 - 3GHz RANGE

1) Press POWER pushbutton to ON.
2) Press .2 - 3GHz pushbutton

3) Apply .2 - 3GHz signal to 50Ω Type N connector.

4) Select desired readout resolution.

5) Measurement is automatic.

3.4.4 Turn-off Procedures

1) Press POWER pushbutton to OFF.

2) Disconnect power cord from ac source.

NOTE

Do not disconnect power cord from ac source if B, B3, or B4 Oscillator Option is installed. Crystal oven must remain energized at all times to ensure high-accuracy readout operation.

CHAPTER 4
THEORY OF OPERATION

4.1 INTRODUCTION

Included in this chapter are the general theory and circuit descriptions of the Model 6053 Counter. A general block diagram, along with a timing diagram, are included for reference. Schematics will be found in Chapter 6.

4.2 GENERAL THEORY

The Automatic Computing Transfer Oscillator (ACTO) operates by phase-locking a low frequency oscillator to the applied RF input frequency and computing the harmonic multiple "N". The counter time base is then expanded such that the counter will count the low frequency oscillator for a period equal to "N" times the selected time base. The result is a direct indication of the RF input frequency. Figure 4.1 depicts the basic block diagram for the ACTO. As illustrated, the phase-lock loop incorporates a harmonic phase detector, amplifier search oscillator, and a voltage-controlled oscillator. The free-running search oscillator sweeps the voltage-controlled oscillator over a narrow band of frequencies, producing an output varying in frequency between 17.5 and 19.5MHz. This signal is applied to the harmonic phase detector and is phase-compared to the RF input. When an exact oscillator harmonic is encountered, a dc voltage is generated which disables the sweep oscillator and locks the voltage-controlled oscillator to a sub-multiple of the input frequency.

Since the harmonic number (N) is unknown, it is not possible to measure the exact input frequency. Therefore, a second output from the voltage-controlled oscillator is extracted and applied to a single-sideband generator. The generator is modulated at a 1kHz rate resulting in an output equal to the oscillator's frequency shifted by 1kHz. This signal is now applied to a harmonic phase detector, the output of which is equal to 1kHz x N.

Since the original 1kHz modulation frequency and the 1kHz x N are present, it is possible to compare the two frequencies digitally and extract the corresponding harmonic number (N). This is the function of the N compute and control circuit. Having extracted N, the N compute and control circuit expands the time base period by the appropriate factor of N to provide a direct readout of the input frequency.

4.3 CIRCUIT DESCRIPTIONS

4.3.1 POWER SUPPLY (Schematic C39082)

The Model 6053 power supply provides both regulated and unregulated voltages from either a 115V or 230V, 50 to 60Hz source.

Primary power arrives at the primary windings of power transformer T1 from the ac line cord, through a line filter, fuse F1, and a POWER/ON switch S1. The power transformer provides three separate secondary windings from which the following voltages are obtained: +225V dc (indicator tubes), +5V dc (logic), and ±15V dc (bias). A special ACTO +5V dc and -5.2V dc are provided with additional circuitry.

+225 Supply (unregulated)

The +225V supply voltage is produced in the following manner: approximately 175V rms from the T1 secondary winding, 5-6 is half-wave rectified by CR5. The resultant voltage is distributed to the indicator tube circuitry on the Readout Board via pin E30.

+15V Supply (regulated)

The regulated +15V supply is based on 35V rms from the center-tapped secondary winding, 10-11-12. A full-wave bridge rectifier, CR1-CR4, and filter capacitor C2 produce a +22 volt dc potential which is applied to the integrated circuit regulator, U1. The regulated +15V output is then controlled by the series pass transistor Q1, permitting about 300mA maximum current at pins E19-E21.

-15V Supply (regulated)

The regulated -15V supply is based on 35V rms from the center-tapped secondary winding, 10-11-12, and referenced to the +15V regulated supply. The -22 volt dc potential, filtered by C3, is fed through R8 and pass transistor Q4 to the differential amplifier Q2 and Q3. This amplifier keeps the junction of R7 and R9 at 0 potential.

Since R7 and R9 are equal, the voltage drop across each is the same. Thus, if R2 adjusts the +15V supply, the -15 volts across R9 will track. 300mA is available at pins E26-E28.

+5V Supply (regulated)

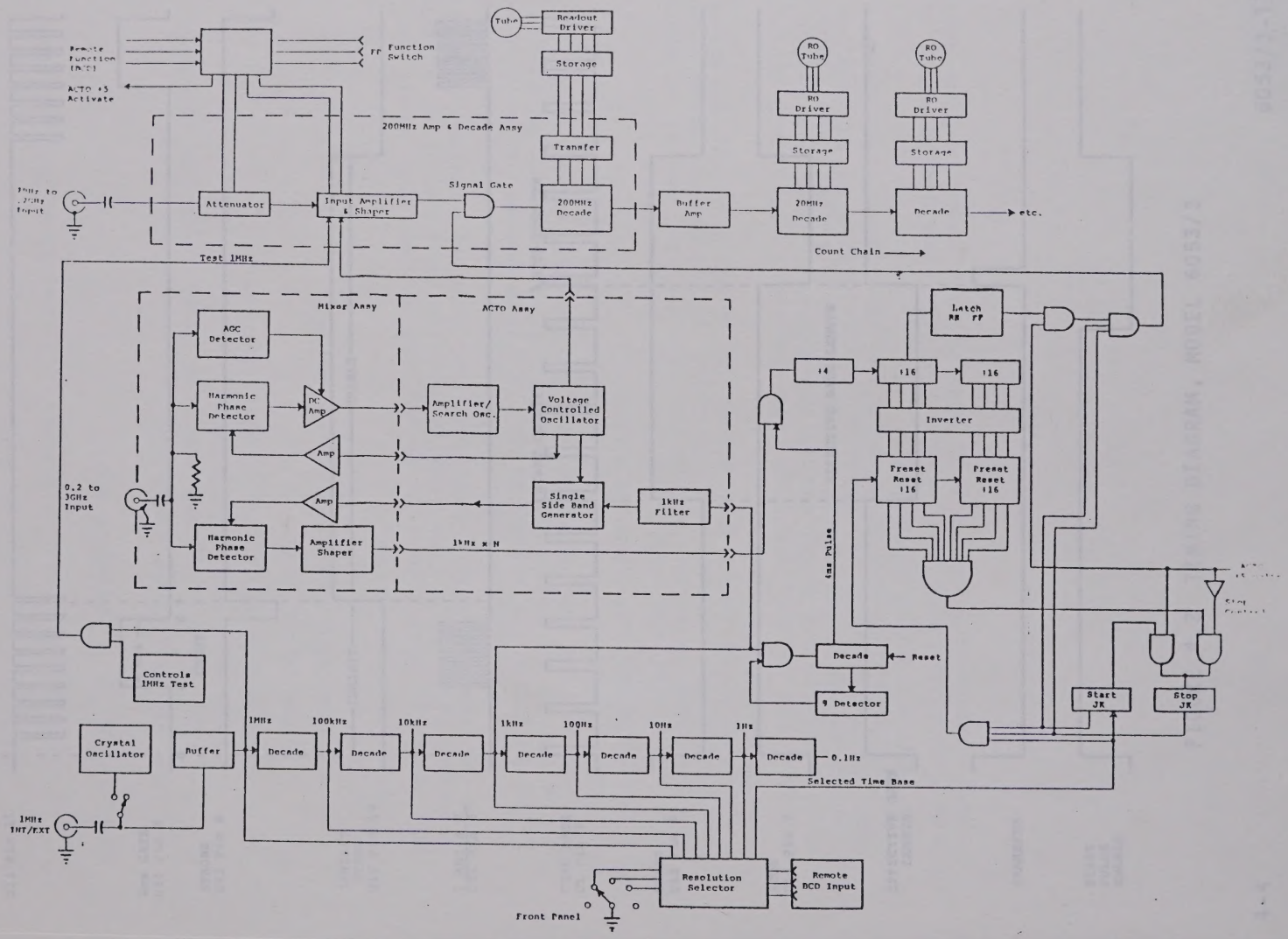
From secondary winding 7-8-9 of T1 and the full-wave bridge, CR6-CR9, a +9V potential is fed to IC regulator U2. The resulting regulated +5Vis then passed by Q9, providing about 1.35A of current at E24-E25.

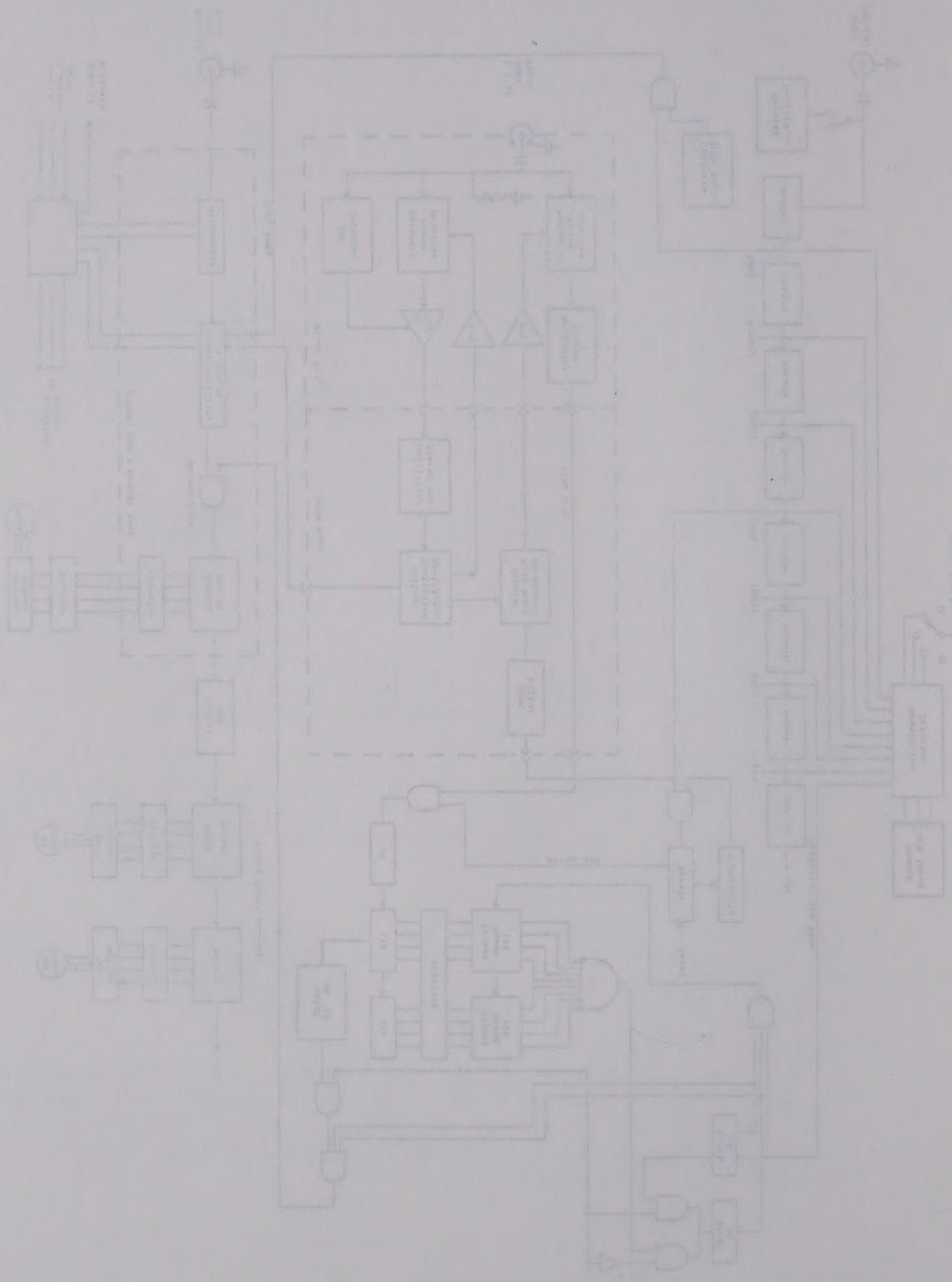
-5.2V Supply (regulated)

From secondary winding 7-8-9 of T1 and the full-wave bridge, a -9V potential is fed to buffer amplifier Q7 and Q8; then, the differential amplifier Q5 and Q6 which references the resulting -5.2Vwith the regulated +5V supply.

ACTO +5 (regulated)

This supply is referenced to the +15 volt supply by the differential pair contained in U3 and adjusted by R17. The pass transistor Q11 allows 2.0A maximum at E22-E23. E29 is the ACTO enable line which enables Q10 when the ACTO line is grounded, turning on U3.


Remote Function (BCD)
ACTO +5 Activate
FF Function Switch
Tube
Readout Driver
Storage
Transfer
200MHz Amp & Decade Assy
Attenuator
Input Amplifier & Shaper
Signal Gate
200MHz Decade
Buffer Amp
RO Tube
RO Driver
Storage
20MHz Decade
Decade
etc.
Count Chain
Test 1MHz
Mixer Assy
ACTO Assy
AGC Detector
Harmonic Phase Detector
DC Amp
Amplifier/ Search Osc.
Voltage Controlled Oscillator
Amp
Amp
Single Side Band Generator
1kHz Filter
Harmonic Phase Detector
Amplifier Shaper
1kHz x N
0.2 to 3GHz Input
Latch RB FF
÷4
÷16
÷16
Inverter
Preset Reset ÷16
Preset Reset ÷16
Gate Pulse
Decade
Reset
9 Detector
Start JK
Stop JK
Controls 1MHz Test
Crystal Oscillator
Buffer
1MHz
100kHz
10kHz
1kHz
100Hz
10Hz
1Hz
Decade
0.1Hz
Selected Time Base
1MHz INT/EXT
Resolution Selector
Remote BCD Input
Front Panel



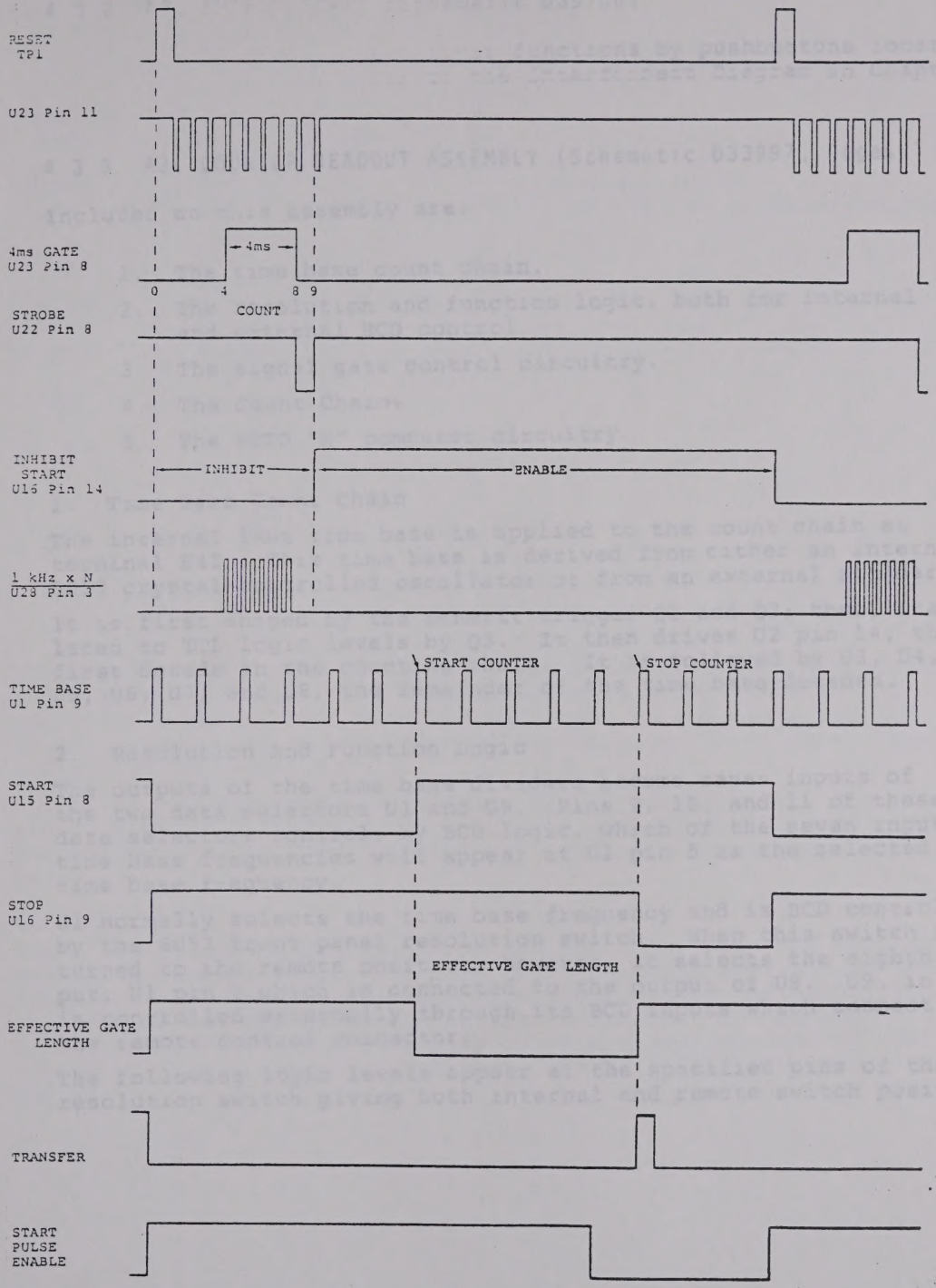
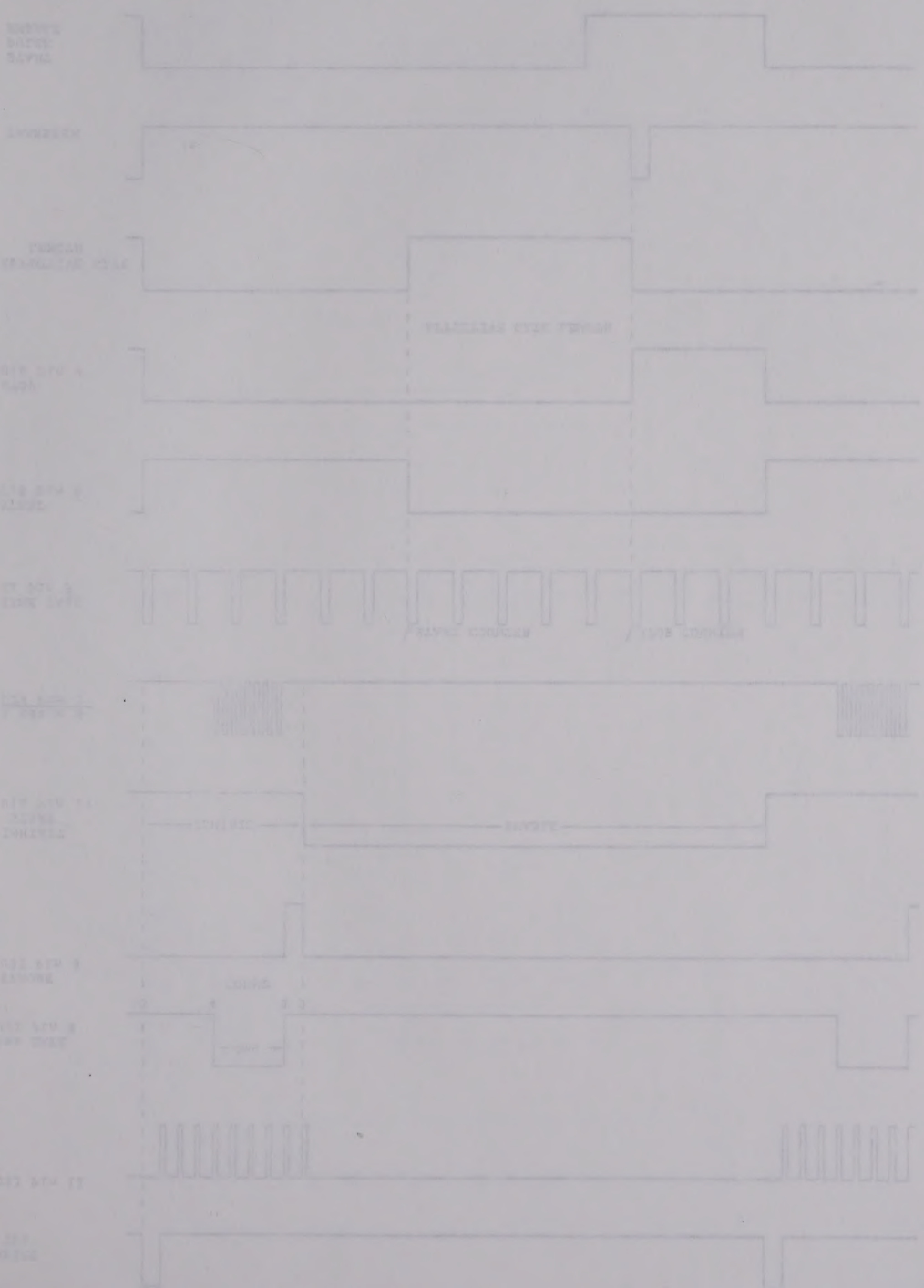


FIGURE 4.2 TIMING DIAGRAM, MODEL 6053/3



4.3.2 A2, SHIFT BOARD (Schematic D39100)

... functions by pushbuttons located ... the Interconnect Diagram in Chapter 6.

4.3.3 A3, COUNTER READOUT ASSEMBLY (Schematic D33997, Pages 1 & 2)

Included on this assembly are:

1. The time base count chain.
2. The resolution and function logic, both for internal and external BCD control.
3. The signal gate control circuitry.
4. The Count Chain.
5. The ACTO "N" computer circuitry.

1. Time Base Count Chain

The internal 1MHz time base is applied to the count chain at terminal E42. This time base is derived from either an internal 6053 crystal-controlled oscillator or from an external standard.

It is first shaped by the Schmitt trigger Q1 and Q2; then, translated to TTL logic levels by Q3. It then drives U2 pin 14, the first decade in the counting chain. It is followed by U3, U4, U5, U6, U7, and U8, the remainder of the time base decades.

2. Resolution And Function Logic

The outputs of the time base dividers become seven inputs of the two data selectors U1 and U9. Pins 9, 10, and 11 of these data selectors control, by BCD logic, which of the seven input time base frequencies will appear at U1 pin 5 as the selected time base frequency.

U1 normally selects the time base frequency and is BCD controlled by the 6053 front panel resolution switch. When this switch is turned to the remote position, however, it selects the eighth input, U1 pin 1 which is connected to the output of U9. U9, in turn, is controlled externally through its BCD inputs which connect to the remote control connector.

The following logic levels appear at the specified pins of the resolution switch giving both internal and remote switch positions.

TABLE 4.1 LOGIC STATES

Internal Pins	E4		E8	E9		
Remote Pins	E37		E39	E41	Decimal Point Position	Binary Number
Remote	0		1	1	-	3
100 kHz	0	GHz	0	0	4	0
10 kHz	0	GHz	0	1	5	1
1 kHz	0	GHz	1	0	6	2
100 Hz	1	MHz	0	0	4	4
10 Hz	1	MHz	0	1	5	5
1 Hz	1	MHz	1	0	6	6
0.1 Hz	1	MHz	1	1	7	7

The logic level at J5 if it is in the 1 state, drives U14 pins 1, 2 and 4 to the 1 state. Pin 3 of U15 goes to 0 and pin 6 of U15 goes to a 1 state. Pin 6 of U14 then goes to a 0 state turning Q6 off, extinguishing the GHz lamp and turning Q7 on; thus, supplying current to the MHz lamp.

A 0 at J5 has the opposite effect. By the presence of a 0 at U14 pin 4, U14 pin 6 is driven to a 1 state turning Q6 on, supplying current to the GHz lamp, turning Q7 off, extinguishing the MHz lamp.

Decimal Point

There are three decimal points in the GHz range and four decimal points in the MHz range. As seen from the chart they are positions 4, 5, 6, and 7. They are,with the exception of number 7, the same in the MHz range and in the GHz range. The decimal points are located in the display tubes and are switched by U29, a 4 to 10-line converter. The logic levels at the inputs of U29 are:

Tube	A	B	C	D
4	0	0	1	0
5	1	0	1	0
6	0	0	1	0
7	1	1	1	0

Since the logic levels in the C and D columns do not change they are permanently wired to the 1 and 0 logic levels. The logic levels at A and B are obtained from the terminal lugs, J3, J4 and are inverted by the two gate functions of U10, driving the 4 to 10-line converter U29 which lights the correct decimal point.

When the resolution switch is in the remote position, the decimal point logic is supplied to the external rear panel connector J5 through the other two gating elements of U10.

Function Switch

The front panel function switch is a set of six pushbuttons which supply BCD information to three sections of the quad gate U11. When the resolution switch is in "Remote", the 6053 functions are controlled by BCD from rear panel connector J5, operating the three sections of the Quad gate U12. The functions and BCD information required at lugs E31, E38, and E36; E33, E28, and E29 respectively are as follows:

TABLE 4.2 FUNCTION BCD

Remote	E33	E28	E29
Front Panel Control	E31	E38	E36
Test	1	0	0
Hi Frequency	0	0	0
X1	1	1	1
X10	0	1	1
X100	1	0	1
X1k	0	0	1

3. Signal Gate Control

The unijunction transistor Q13 fires developing a positive pulse at base 1. This is amplified and inverted by Q14 and turns Q15 off for the duration of the pulse. The positive pulse at the collector of Q15 resets all the counting decades, the 1Hz and 0.1Hz time base decades, as well as U26, U27, and U23. The positive pulse is inverted by U25 and then resets U16, U30; it is also available at pin E24.

U23, a decade counter, is normally driven by 1kHz from U4, a time base divider, through the gate function U17. It will count the 1kHz until the decade reaches the count of nine, at which time it drives the two input pins 4 and 5 of U22 to the 1 state. Pin 6 of U22 then becomes a 0 and disables U17, preventing any more 1kHz pulses from reaching the input of U23. Pin 6 of U22 is inverted by U18. Pin 8 of U18 then becomes an inhibit-start signal for the stop flip-flop U16 by holding the J line, pin 14, of U16

down in the 0 state. Pin 12 had been set to the 1 state by the negative reset pulse at pin 6 and pin 2.

The dual JK flip-flop U16 is initially reset with pin 12 and pin 9 in the logical 0 state. (Low voltage state.) The voltage at pin 13 ($\overline{Q}$) is in the 1 state and is inverted by U17 to cause J (pin 7) to be in the 0 state preventing pin 8 (Q) from being driven.

Upon receipt of one of the time base pulses at pins 1 and 5, pin 12 is driven to the 1 state which permits the 6053 signal gate to open. At the same time pin 13 goes to the 0 state and after being inverted by U17, brings pin 7 (J input) to the 1 state.

The next time base pulse arriving at pins 1 and 5 cannot drive the left-hand flip-flop because pin 3 (K) is held in the 0 state and inhibits the flip-flop.

The time base does drive the right hand flip-flop (pin 5) causing pin 8 ($\overline{Q}$) to be in the 0 state. Pin 10 (J) is grounded so no further inputs will be accepted. Pin 8 now inhibits the signal gate and the 6053 count chain no longer has an input.

Transfer Pulse

When the right-hand flip-flop in U16 is driven, Q (pin 9) is driven to the 1 state. This is inverted by the gate function U11 after which it is differentiated by C4 and R24. It passes through CR2 and turns off Q10. A positive pulse appears at the collector of Q10 which transfers the BCD information contained in the count decades to the SN7475 storage packs.

The stored BCD now contained in the SN7475's is converted to 10 line information and drives the gas display tubes V1 thru V9.

Reset

Pin 8 of U16 is coupled thru R27 to the base of Q12. At the end of the count period Q12 turns off. C5 is then permitted to begin charging to +15V thru R33. When it reaches about +7V the uni-junction transistor Q13 fires, discharging C5 to ground. A positive pulse is developed across R29 and coupled through R30 to the base of Q14. A reset pulse is generated which drives pin 8 of U16 positive, causing Q12 to turn on and clamp C5 to ground. Now the whole cycle repeats.

4. Count Chain

The count chain consists of U35, U38, U41, U44, U47, U50, U53, and U56. U35 is a SN7490, the remainder are SN7090 decades. The first decade in the count chain is not on the read-out board, but instead, is a separate assembly. In the 6053 the first decade is capable of counting up to 200MHz. The input amplifier and signal gating circuits are included on the separate Amp and Decade assembly.

The output of the first decade comes into the Readout Board at E18 and E19. The signal is amplified by Q4 and Q5; then, drives the input (pin 14) of U35. Pin H of U35 couples to pin 14 of U38, and so on.

The BCD information enters the Readout Board at lugs E11, E12, E13, and E17 where it is stored in U32. The output of U32, [illegible] the control circuitry on pins 4 and 13, is [illegible] by U31 (SN7441). The output of U31 grounds one of the [illegible] at the gas display tube V1 causing a number to glow.

The remaining storage packs (SN7475) are U34, U37, U40, U43, U46, U49, U52, and U55, and operate in the same manner.

5. ACTO Computer

The ACTO N computer causes the time base period selected by the front panel resolution switch to be expanded by some factor. Typically that factor will be the harmonic number "N".

When the 0.2-3GHz button is depressed, lug E30 goes to near ground which enables the ACTO +5V power supply. The ACTO +5V enters the readout board at E44. It enables U17 pin 4 and, after being inverted by U18 pin 10 and 11, inhibits U17 pin 1. The effect of this is to prevent the stop flip-flop (U16 pin 9) from being driven until U19 pin 8 goes to the 0 state.

As shown in the timing diagram, the sequence of operation is inhibited by the reset pulse. The decade U23 is first reset to zero; then, counts the 1kHz pulses until it reaches the count of nine, at which time, U17 becomes disabled and the decade counts no further until the next reset pulse.

When the decade U23, reaches the count of four, pin 8 goes to the 1 state. This enables the gate U12 and raises the JK lines of U28, a dual JK flip-flop, to the 1 state. 1kHz x N pulses are then divided by four in U28. The (1kHz x N) ÷ 4 is then counted by the two cascaded divide-by-16 counters U26 and U27 until U23 reaches the count of 8. At this time U12 is disabled and the JK lines of U28 are grounded. Since (1kHz x N) ÷ 4 has been counted for four periods of 1kHz, N counts will be counted. When U23 reaches the count of 8, pin 1 of U20 and U21 go to the 0 state and return to the 1 state when U23 reaches the count of nine.

When strobed by a negative pulse on pin 1, the integrated divide-by-sixteen counters U20 and U21 are reset to the condition set up by the BCD inputs on pins 4, 10, 3, and 11.

The information contained in U26 and U27 is inverted so that a compliment of the BCD information is applied to the BCD input lines of U20 and U21.

If the number N is 34 then the compliment would be the full capacity of the two divide-by-16 counters minus 34.

When the decade reaches the count of nine, U16 pin 14 goes to the 1 state permitting a start pulse to be accepted. U15 pin 8 goes to the zero state. U15 pins 1, 2, 12, and 13 become enabled permitting the time base pulses to pass through U15 to pin 8 of U20. U20 and U21 then continue to count the time base pulses, triggering on the trailing edge of the pulses. When U20 and U21 reach the condition 1111 or full capacity, pin 8 of U19 goes to the

zero state. This occurs on the trailing edge of a timing pulse. This is inverted by U17 pin 4, 5, and 6 and enables pin 7 of U16 which permits the leading edge of the time base to drive the stop JK flip-flop. Pin 8 of U16 is driven to the zero state and inhibits U15. The preset divide-by-sixteen counters U20 and U21 no longer count the time base.

During the time that the ÷16 preset-reset counters are counting the time base, U15 pin 8, the start line, and U16 pin 9, the stop line are both near ground in the zero state. During this time the counting decades are counting the ACTO VCO frequency.

If N = 100 and the ACTO VCO frequency = 19MHz, then the input frequency is 1900.0MHz or 1.9GHz and will be displayed by the 6053 readout tubes.

4.3.4 200MHz AMP AND DECADE (Schematic D39095)

The 200MHz Amp and Decade circuit description consists of the following sections:

1. X100 Input Attenuator.
2. High input impedance, gain-controlled input stage.
3. Two stages of grounded emitter and two stages of emitter follower amplifier.
4. Schmitt trigger.
5. Signal Gate.
6. 200MHz MECL decade counts with translator to provide TTL BCD logic level output.

The input to the 200MHz Amp and Decade is capacitor-coupled to the input attenuator. This attenuator is controlled by a relay and has an attenuation factor of X1 or X100.

The output of the attenuator is applied to gate 1 of the MOS transistor Q2. This transistor has a voltage gain of 2 or 0.2 and is controlled by the bias on gate 2.

An emitter follower Q3 dc couples this stage to the wide-band amplifier Q5, Q6, Q7, and Q8.

The output of Q8 is applied to the input of the Schmitt trigger, Q9-Q12. The operational amplifier U1, by comparing the dc voltage at the input to the Schmitt trigger, and the voltage at the trigger level pot (R47), adjusts the bias at the base of Q1 to cause the two voltages to become equal.

Two other inputs are provided for the amplifier circuit. One on J2-4 accepts the 1MHz test frequency provided in the 6053. The other, J4 accepts the 20MHz oscillator frequency from the ACTO. When either of these two inputs are used Q2 is turned off by reverse biasing gate 2, thus disabling the normal input.

The Schmitt trigger Q9, Q10, Q11, and Q12 is a conventional high-speed circuit. The input is applied to the base of transistor Q9 which drives emitter follower Q11; then, transistor Q10. The output from Q10 is coupled to the signal gate U2 pin 4 by emitter follower Q12.

The signal gate is turned on and off by applying a voltage at J2-9 and J2-8. A positive (+5V) disables the gate and a ground at these points.

The decade consists of four MECL Flip-Flops U3, U4, U5, and U6. The output of the decade is buffered by the second half of U2 and goes out on J2-5 and J2-6. The MECL BCD logic levels are translated to TTL logic levels by the translator U7.

4.3.5 A5, ACTO (Schematic C39087)

The search oscillator generates the triangular waveform that sweeps the voltage-controlled oscillator (VCO). Transistors Q1 and Q2 form a binary switch. In the following example and with no input present, Q1 conducts while Q2 is held "off". Current flows from the -5.2 volt supply, through Q1 and R9 into the input of amplifier U1 (pin 2). U1 inverts and, due to the feedback network (C2, R5) produces a linear rise in voltage at the output (pin 6). When the output voltage reaches +10V (15 volt difference of potential), CR1 conducts, forward biasing Q2. Q2 now conducts while Q1 is held "off". This action causes the amplifier (U1) to draw current from the positive supply through R12, driving the output in a negative direction until it reaches -5 volts. At -5 volts, Q2 is turned "off" and Q1 is turned "on", repeating the cycle. The net effect is a triangular waveform varying between +10 and -5 volts (TP1).

Voltage-Controlled Oscillator ACTO

The triangular waveform is now applied to the base of emitter follower Q3, and into the voltage-controlled oscillator's (VCO) frequency determining tank circuit (CR3, CR4, and L2). CR3 and CR4 are "varicap" type diodes whose capacitance is inversely proportional to the bias applied.

Note that, the varicap curve is nonlinear. To compensate for this nonlinearity, corrective networks consisting of a resistor and a diode in series (R6, CR2, and R3, CR8) are placed across the triangular wave generator load resistor (R15). The effect of these two networks is a nonlinear curve which opposes the varicap curve, resulting in a more linear function.

Single-Sideband Generator

The output from the VCO must be shifted in frequency by 1kHz in order to properly drive the "N" channel harmonic mixer, and must be sinusoidal to drive the single-sideband generator.

The VCO signal is obtained from the emitter of Q5, filtered by R23, C31, L6 and C32 to reduce harmonic distortion, and is then split into two components, separated in phase by 90°. Phase separation is accomplished by an LR phase lag circuit (L7, R50) and CR phase lead circuit (C19, R49). The resultant signals are used to drive balanced modulators (U2).

Simultaneously, a 1kHz signal from the time base is routed to the base of Q10. Transistor Q10 inverts and amplifies the signal. A "twin T notch filter" on the collector of Q10 is tuned to block 1kHz, passing all other frequencies. Q11 FET transistor provides a negative feedback path for all frequencies except

The decade consists of four MECL flip-flops U7, U6, U5, and U4. The output of the decade is buffered by the second half of U2 and goes out on J3-5 and J3-6. The MECL ECD logic levels are translated to TTL logic levels by the translator U7.

4.3.5 A5, A5U3 (Schematic C35027)

The astable oscillator generates the triangular waveform that sweeps the voltage-controlled oscillator (VCO). Transistors Q1 and Q2 form a binary switch. In the following example and with no input present, Q1 conducts while Q2 is held "off". Current flows from the -5.2 volt supply, through Q1 and R9 into the input of amplifier U1 (pin 2). U1 inverts and, due to the feedback network (C2, R5), produces a linear rise in voltage at the output (pin 6). When the output voltage reaches +10V (15 volt difference of potential), CR1 conducts, forward biasing Q2. Q2 now conducts while Q1 is held "off". This action causes the amplifier (U1) to draw current from the positive supply through R11, driving the output in a negative direction until it reaches -5 volts. At -5 volts, Q2 is turned "off" and Q1 is turned "on", repeating the cycle. The net effect is a triangular waveform varying between +10 and -5 volts (TP1).

Voltage-Controlled Oscillator A5U2

The triangular waveform is now applied to the base of emitter follower Q3, and into the voltage-controlled oscillator's (VCO) frequency determining tank circuit (CR3, CR4, and L2). CR3 and CR4 are "varicap" type diodes whose capacitance is inversely proportional to the bias applied.

Note that, the varicap curve is nonlinear. To compensate for this nonlinearity, corrective resistors consisting of a resistor and a diode in series (R6, CR2, and R1, CR8) are placed across the triangular wave generator load resistor (R15). The effect of these two networks is a nonlinear curve which opposes the varicap curve, resulting in a more linear function.

Single-Sideband Generator

The output from the VCO must be shifted in frequency by 1kHz in order to properly drive the "H" channel harmonic mixer, and must be sinusoidal to drive the single-sideband generator.

The VCO signal is obtained from the emitter of Q5, filtered by R23, C13, L6 and C32 to reduce harmonic distortion, and is then split into two components, separated in phase by 90°. Phase separation is accomplished by an 1X phase lag circuit (L7, R30) and CX phase lead circuit (C19, R49). The resultant signals are used to drive balanced modulators (U2).

Simultaneously, a 1KHz signal from the time base is routed to the base of Q10. Transistor Q10 inverts and amplifies the signal. A "twin T notch filter" on the collector of Q10 is tuned to block 1kHz, passing all other frequencies. Q11 FET transistor provides a negative feedback path for all frequencies except

1kHz. The remaining 1kHz signal, at the collector of Q11, is now capacitively coupled to the base of phase-splitting amplifier Q8. Two separate 1kHz signals, 90° out-of-phase, are extracted from Q8: The non-inverted signal from the emitter circuit and the 90° leading signal from the emitter of Q9. These signals are capacitively coupled to the balanced modulators in U2. The first balanced modulator removes the carrier frequency, and the second modulator removes one sideband resulting in a single-sideband signal. The net effect of this action is the shifting of the carrier frequency by 1kHz. The balanced modulators (U2) are a pair of differential amplifiers utilizing the carrier to drive the common mode inputs. U3 sums the outputs of the balanced modulators and converts them to a single output.

4.3.6 A6, ACTO MIXER/DRIVER (Schematic C27988)

The mixer/driver assembly consists of two sampling-type mixers, including the local oscillator drive circuits and output amplifiers.

The output of the ACTO VCO is applied to terminal A on the Driver Amp. It is amplified by the differential amplifier/limiter Q101 and Q102. The output is tuned broadly by the π network consisting of C109, L101, and C103. R101 and C107 are the bias network for the step recovery diode CR101.

As the voltage at the anode of CR101 becomes positive CR101 conducts heavily, charging the capacitor C107. When the voltage tries to reverse, the diode CR101 continues to conduct for a time. When it finally reverses, it does so very abruptly. Since all of the current through CR101 has been passing through the printed circuit inductors a voltage transient develops when the current is no longer available. A negative pulse is formed at the anode of CR101 and a positive pulse at the cathode of CR101. These two pulses are approximately 1.2 volts in amplitude and 0.5nsec in width at the base line. They are coupled through C101, X1, P1, and C102, X2, P2 to the mixer P.C. Assy.

This has been a description of the lock channel driver. The N channel driver (Q103, Q104, and CR102) operates in exactly the same manner.

Sampling Bridge

The negative pulse from P1 is terminated in R1; then, coupled through C1 to the cathode of CR2.

The positive pulse from P2 is terminated in R2; then, coupled through C2 to the anode at CR1. CR1 and CR2 detect these pulses and set up a positive 0.7 volt bias on the cathode of CR2 and negative bias on the anode of CR1. The voltage at the junction of R5 and R6 is nominally zero volts dc.

The second sampling bridge CR3, CR4, R7, and R8 operates identical to the first.

The RF input signal (200MHz to 3GHz) is applied to the input of both sampling bridges (junction of CR1, CR2, and junction of CR3, CR4). It is then terminated into R9, a 50Ω chip resistor.

The output of the lock phase detector bridge is amplified by U1, an operational amplifier. The dual FET Q1 is used as source followers to reduce the signal input current requirement by the amplifier. The output of the amplifier is present at lug "C" on the mixer P.C. board.

To improve the dynamic range of the ACTO and the overload characteristic, an AGC system is used.

CR5 is used as an AGC Detector and detects the level of RF applied to the input of the instrument. The dc voltage drop across CR5 is cancelled out by an opposing voltage drop across CR6. The detected dc voltage is then amplified by the operational amplifier U2. A negative voltage is developed on the output of this amplifier and biases Q3, an N channel FET. Q3 is used as a voltage-controlled resistor which, by altering the negative feed-back, controls the gain of the lock channel amplifier U1.

The dc feed-back network around U2 is designed to have a nonlinear gain curve which matches the voltage to resistance curve of Q3.

The output of U1 on the Mixer P.C. Board goes out to lug "C"; then, through the connecting cable to pin 14 of J2 on the ACTO assembly. There it connects to the input of U1, the search oscillator/amplifier.

When in a phase lock condition, a voltage appears at pin 14, J2 which cancels the current supplied by R9 to pin 2 of U1. Then the search oscillator is over-powered and U1 becomes simply an amplifier.

The N channel amplifier/shaper consists of Q2 and U3. Q2 is a source follower which presents a high impedance load to the N channel phase detector (actually used as a mixer).

Transistor Q2 is followed by an emitter follower; then, a grounded base stage. The output of the grounded base stage drives the Schmitt trigger. The shaped output from the Schmitt trigger drives the grounded emitter amplifier. This last amplifier provides square waves at terminal "X", at TTL logic levels. All the amplifying and shaping is done with five transistors in U3, a transistor array.

The signal at terminal "X" is 1kHz x N. The input of the Schmitt trigger (pin 4 of U3) goes to a lug TP1 and is available as 1kHz x N priorto shaping.

CHAPTER 5

CALIBRATION-MAINTENANCE

5.1 INTRODUCTION

This chapter is devoted to maintaining the factory-new performance of the Model 6053 Counter. A calibration procedure, acceptance test and troubleshooting guide have been included for this purpose.

5.2 FACTORY SERVICE

Whenever the instrument requires service, other than normal calibration, the nearest Systron-Donner representative should be contacted. He can provide field service or arrange factory service when necessary. Address all inquires on operation or application to your nearest sales representative, or to:

Sales Manager-Concord Instrument Division
Systron-Donner Corporation
888 Galindo Street
Concord, California 94520

Be sure to specify the complete model and serial number in all correspondence.

5.3 PART LOCATION

Printed circuit board outline drawings and related parts lists have been included in Chapter 6 to facilitate part identification and location.

5.4 CALIBRATION PROCEDURE

The following test equipment is required for calibration and adjustments:

(1) Oscilloscope	Tektronix	Model 581 A or equiv.
(2) Voltmeter	Systron-Donner	Model 9000 or equiv.
(3) Voltmeter	Simpson	Model 260 or equiv.
(4) 1MHz frequency standard; 1 part in 10^{-10} short term.		
(5) Signal Generator	H.P.	Model 608 E or equiv.
(6) RF Voltmeter	H.P.	Model 411 A or equiv.

5.4.1 Power Supply Adjustments (Schematic C39082)

The following chart indicates the proper supply voltages and their associated adjustment controls. All are located on the Power Supply P.C. Assembly. The SD 9000 DVM is used for these measurements.

TABLE 5.1 POWER SUPPLY ADJUSTMENT

LOCATION	VOLTAGE		TOLERANCE
E20	+15.00	R2 +15 adjust	±.10Vdc
E24	+5.00	R4 +15 adjust	±0.01Vdc
E31	-5.20	R13 -5.2 adjust	±0.01Vdc
E27	-15.00	None (R2 +15 adjust)	±1Vdc
E22	+5.00	R17 ACTO +5 adjust	±0.01Vdc (The 0.2-3GHz pushbutton must be depressed.)
E30	+225	None	+80 ±10Vdc as read with the Simpson 260. Voltage is 225V peak but is half-wave rectified, and unfiltered. This accounts for the low voltage reading.

5.4.2 Oscillator Adjustment

Push on TEST pushbutton. Place 1MHz INT/EXT switch to INTernal. With oscilloscope (1), triggered by the 1MHz (4) frequency standard; monitor the 1MHz IN-OUT BNC for a 2.5V peak-peak (minimum amplitude) 1MHz rectangular wave. Set COARSE frequency adjustment (counter rear panel) to a position which results in most stationary waveform on scope. Set FINE frequency adjustment (optional oscillators) to position which results in most stationary waveform on scope. Place 1MHz INT-EXT switch to EXT. Oscilloscope should no longer display 1MHz signal. Remove calibration equipment.

5.4.3 200MHz Input Amp and Decade Adjustment (Schematic D39095)

1. Push the power switch on and depress the X1 ATTENUATOR button.
2. Apply 200MHz at a level of 10 millivolts. This is measured at the front panel as shown in Figure 5.1.
3. With the Resolution switch in 100kHz position, adjust R47 to obtain a good stable reading. Reduce the input level, and repeat the adjustment to find the optimum setting.
4. Note the input voltage level that is required for a stable reading. Increase this level ten times.
5. Depress the X10 ATTENUATOR button and adjust R50 until the 6053 just barely counts correctly. Reduce the input level and then increase it to the original X10 level. The 6053 should again present a stable display reading. The level required should not exceed 100 millivolts.

LOCATION	VOLTAGE		TOLERANCE
R20	+15.00	R2 +15 adjust	±.10Vdc
R24	+5.00	R4 +15 adjust	±0.01Vdc
R31	-5.20	R43 -5.2 adjust	±0.01Vdc
R27	-15.00	None (R2 +15 adjust)	±1Vdc
R22	+5.00	R17 ACCO +5 adjust	±0.01Vdc (The 0.2-3GHz pushbutton must be depressed.)
R10	+125	None	±50 ±10Vdc as read with the Simpson 260. Voltage is 225V peak but is half-wave rectified, and unfiltered. This accounts for the low voltage reading.

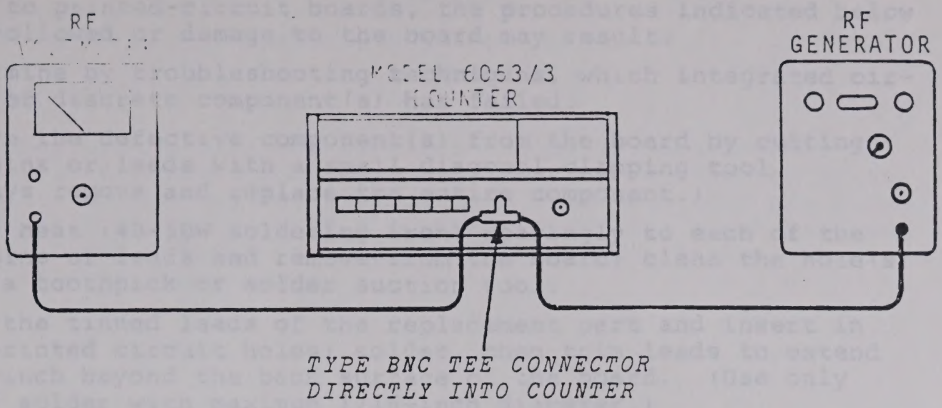


FIGURE 5.1 VOLTAGE MEASUREMENT OF RF INPUT

6. Depress the X100 ATTENUATOR button; then, increase the generator output level another ten times.

7. Adjust C5 so that the 6053 just barely gives a good stable reading. (In later instruments, C5 is not adjustable.)

5.4.4 ACTO ADJUSTMENT (Schematic C39087)

Mixer Balance

1. With no input connected to the 6053, depress the .2 - 3GHz button.

2. Observe the waveform present at TP1 on the ACTO Assy (A5). This should be a symmetrical triangular waveform swinging between +10 and -5 volts.

3. Adjust R17 on the mixer assembly (A6), if necessary, to make the waveform symmetrical.

Gain Set

1. Set the resolution switch to 10^{-3} (1kHz) or 10^{-4} (10kHz) resolution.

2. Apply 3GHz at a level of 50mV rms (-13dBm) to the .2 - 3GHz input of the 6053.

3. Adjust the gain control R24 on the ACTO Assy (A5), so that 6053 correctly indicates the input frequency.

5.5 BOARD REPAIR

NOTE

READ BEFORE CHANGING ANY COMPONENT ON A PRINTED-CIRCUIT BOARD

When replacing integrated circuits or other electronic components soldered to printed-circuit boards, the procedures indicated below must be followed or damage to the board may result:

1. Determine by troubleshooting techniques, which integrated circuit or discrete component(s) has failed.
2. Remove the defective component(s) from the board by cutting the pins or leads with a small diagonal clipping tool. (Always remove and replace the entire component.)
3. Apply heat (40-50W soldering iron) sparingly to each of the cut pins or leads and remove from the board; clean the hole(s) with a toothpick or solder suction tool.
4. Form the tinned leads of the replacement part and insert in the printed circuit holes; solder, then trim leads to extend 1/16-inch beyond the back surface of the board. (Use only 63-37 solder with maximum 1/16-inch diameter.)

CAUTION

Always trim semiconductor leads only after soldered installation is complete. This procedure greatly lessens the possibility of component failure due to shock-wave damage caused by the trimming tool.

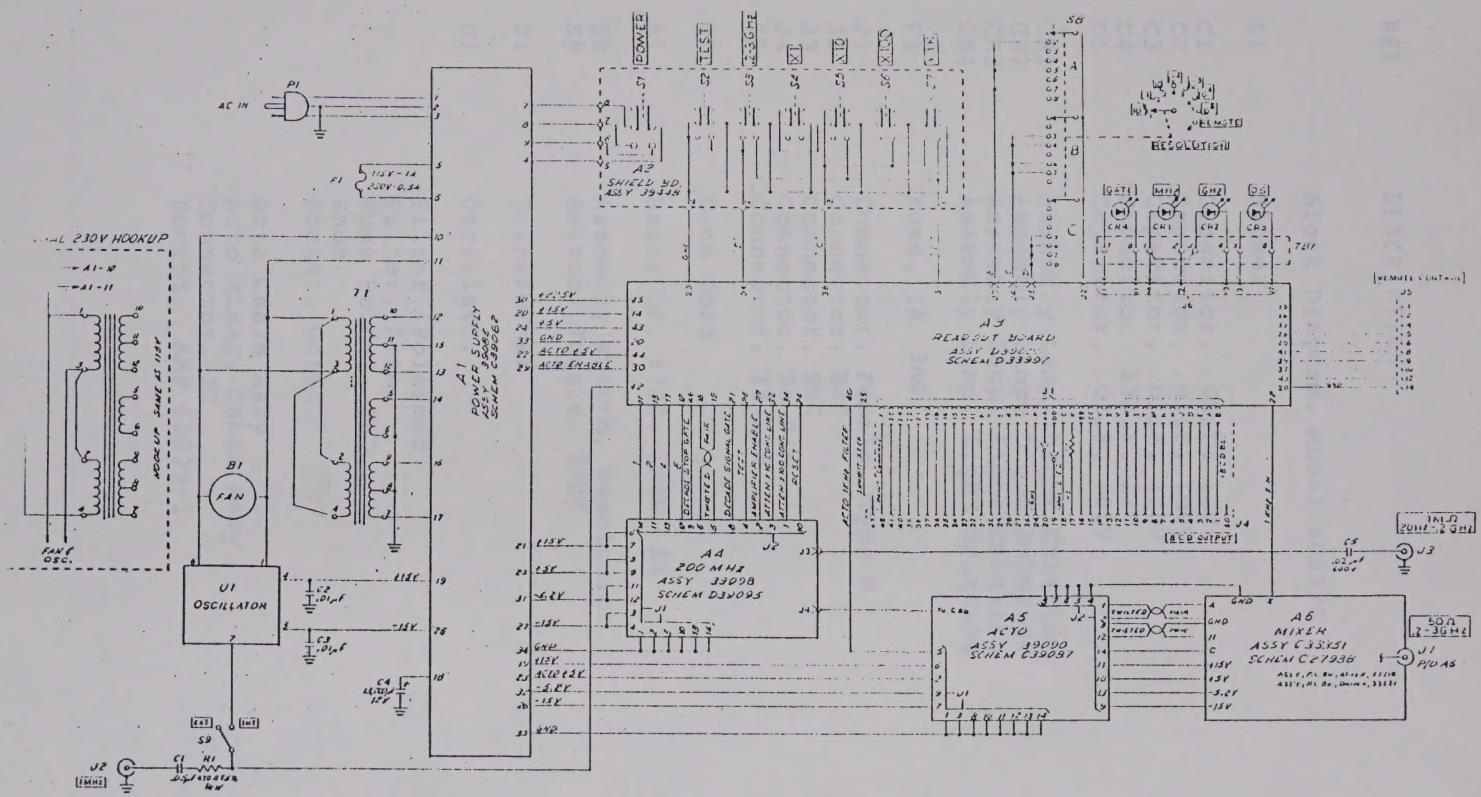
5. When soldering semiconductor devices and all small components, be sure to use a heat sink tool or long-nosed plier connected to the component lead(s) while each is being soldered. Allow the soldered connection to cool before removing the heat sink.
6. Clean all dirt and solder-flux from the printed circuit traces by liberal application of isopropyl alcohol or freon-type solvents.

CHAPTER 6

DRAWINGS AND PARTS LISTS

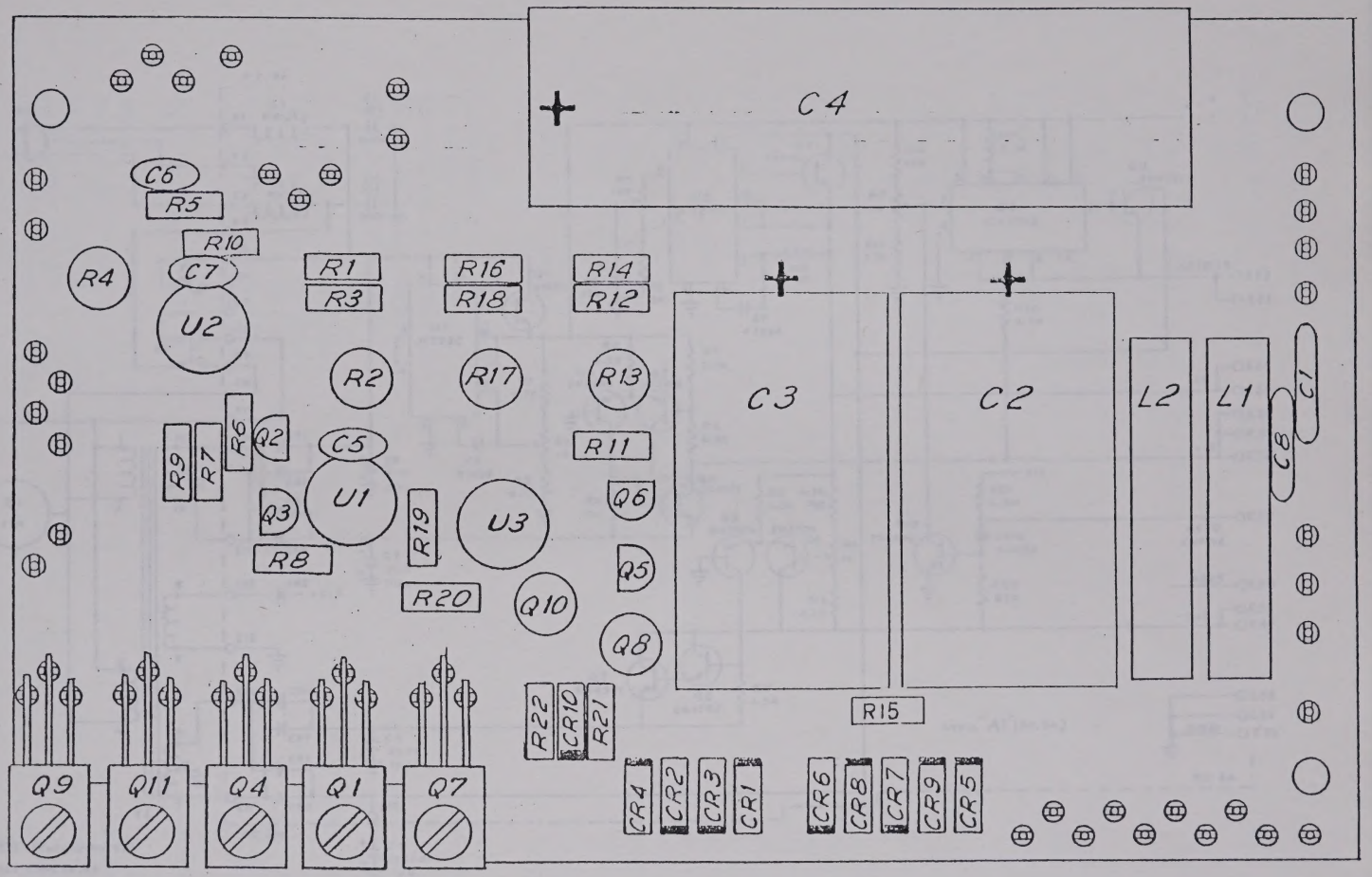
6 1 INTRODUCTION

This chapter contains the drawings and parts list for the SD Model 6053 Frequency Counter. Each section is composed of an assembly, schematic, and a parts list. All sections are arranged in assembly sequence, with the exception of the Block Diagram, and the Block Diagram Parts List - these items follow immediately after this introduction.

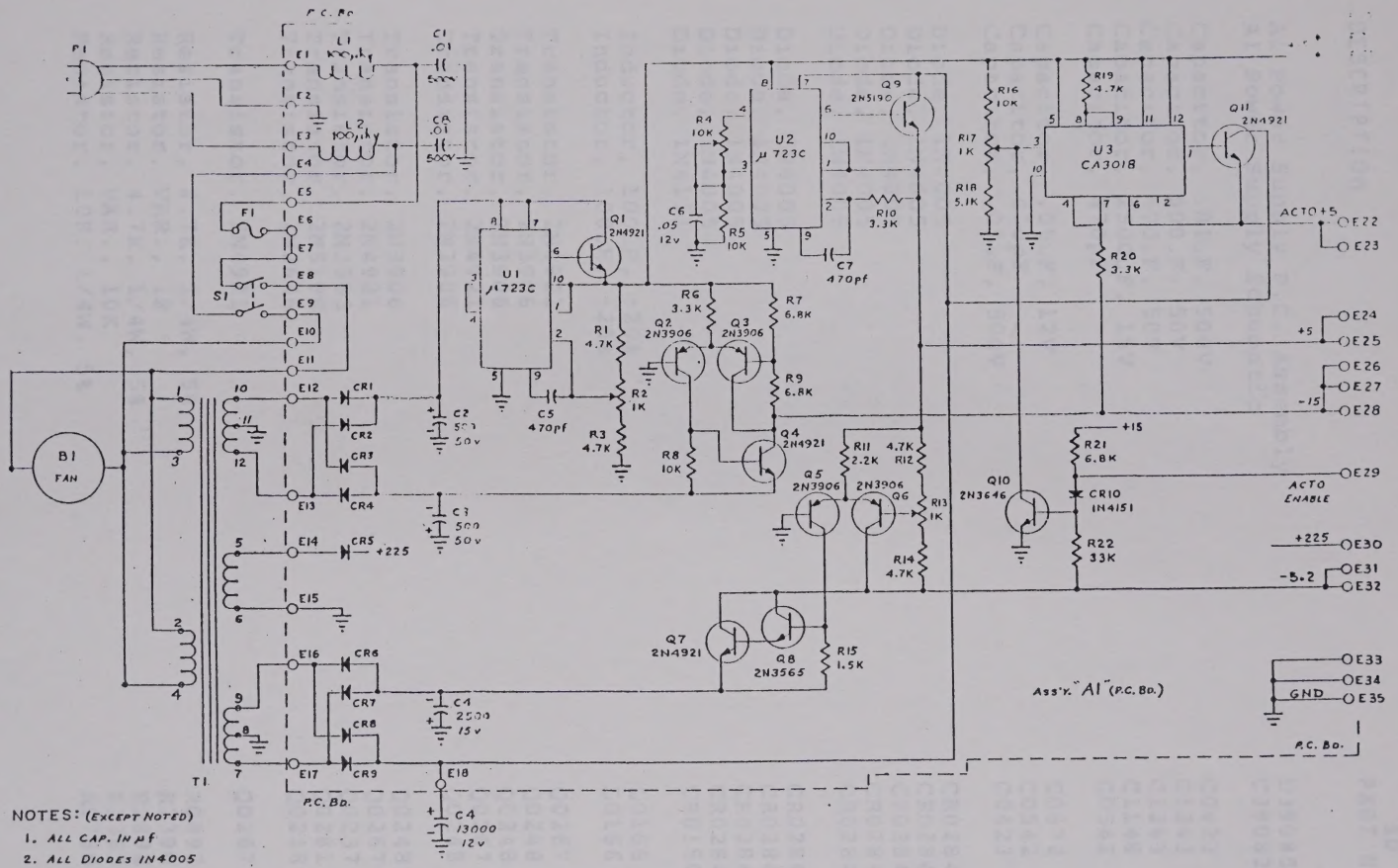


MODEL 6053/3 INTERCONNECT DIAGRAM, D39100R3

REF	DESCRIPTION	SD PART NO
	Block Diagram, Model 6053/3	D39100R3
B1	Blower	H1786
C1	Capacitor, .05μF, 12V	C0672
C2	Capacitor, .01μF, 100V	C0556
C3	Capacitor, .01μF, 100V	C0556
C4	Capacitor, 13KμF, 12V	C1122
C5	Capacitor, .02μF, 600V	C0421
CR1	Assembly Lamp, Light Emitting	CR0367
CR2	Assembly Lamp, Light Emitting	CR0367
CR3	Assembly Lamp, Light Emitting	CR0367
CR4	Assembly Lamp, Light Emitting	CR0367
F1	Fuse, 1A, 3AG	F0001
J1	Connector, Female, Type N	J0552
J2	Connector, BNC	J0165
J3	Connector, BNC	J0260
J4	Connector, 50 Pin	J0170
J5	Connector, 14 Pin	J0310
P1	Line Cord	W0076
R1	Resistor, 470Ω, 1/4W, 5%	R1044
S8	Assembly switch, Resolution	39451
S9	Switch, Toggle, SPDT	S0149
T1	Transformer	39207
U1	Oscillator	33151
	Filter, Polaroid	33922
	Filter, Foam	39410
	Fuse Holder, 3AG	X0034
	Knob	45011360
	Socket, Octal	X0004
	Acto Cable Assy	59469
	Acto Mixer, Cable Assy	29475
	Connector, IC	J0605
	Recept. AMP 60939-1	



A1, POWER SUPPLY ASSEMBLY; D39085R2



NOTES: (EXCEPT NOTED)

1. ALL CAP. IN μf
2. ALL DIODES IN4005
3. ALL RES. ¼W, 5%

A1, POWER SUPPLY SCHEMATIC, C39082R2

VI* POWER SUPPLY SCHEMATIC* C30BS3S

6-5

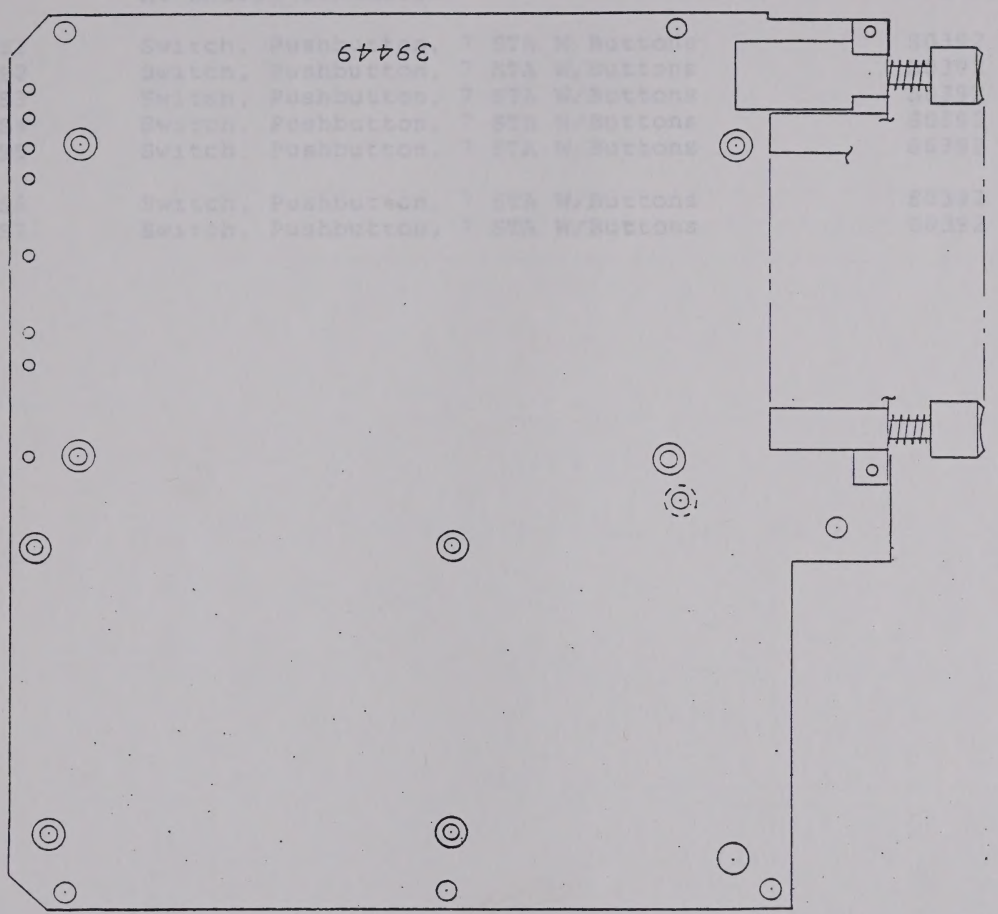
80S313-11-1C

A1 POWER SUPPLY PARTS LIST

REF	DESCRIPTION	SD PART NO.
	A1 Power Supply P.C. Assembly	D39085R2
	A1 Power Supply Schematic	C39082R2
C1	Capacitor, .01uF, 500V	C0423
C2	Capacitor, 500uF, 50V	C1243
C3	Capacitor, 500uF, 50V	C1243
C4	Capacitor, 2500uF, 15V	C1148
C5	Capacitor, 470pF	C0542
C6	Capacitor, .05uF, 12V	C0672
C7	Capacitor, 470pF	C0542
C8	Capacitor, .01uF, 500V	C0423
CR1	Diode, 1N4005	CR0284
CR2	Diode, 1N4005	CR0284
CR3	Diode, 1N4005	CR0284
CR4	Diode, 1N4005	CR0284
CR5	Diode, 1N4005	CR0284
CR6	Diode, 1N4005	CR0284
CR7	Diode, 1N4005	CR0284
CR8	Diode, 1N4005	CR0284
CR9	Diode, 1N4005	CR0284
CR10	Diode, 1N4151	CR0150
L1	Inductor, 100uH, ±20%	L0166
L2	Inductor, 100uH, ±20%	L0166
Q1	Transistor, 2N4921	Q0267
Q2	Transistor, 2N3906	Q0248
Q3	Transistor, 2N3906	Q0248
Q4	Transistor, 2N4921	Q0267
Q5	Transistor, 2N3906	Q0248
Q6	Transistor, 2N3906	Q0248
Q7	Transistor, 2N4921	Q0267
Q8	Transistor, 2N3565	Q0237
Q9	Transistor, 2N5190	Q0281
Q10	Transistor, 2N3646	Q0218
Q11	Transistor, 2N4921	Q0267
R1	Resistor, 4.7K, 1/4W, 5%	R0892
R2	Resistor, VAR., 1K	R2390
R3	Resistor, 4.7K, 1/4W, 5%	R0892
R4	Resistor, VAR., 10K	R2383
R5	Resistor, 10K, 1/4W, 5%	R0766

REF	DESCRIPTION	PART NO
	AL Power Supply P.C. Assembly	D1902SR2
	AL Power Supply Schematic	C1902SR2
C1	Capacitor, .01µF, 100V	C0423
C2	Capacitor, 390µF, 50V	C1243
C3	Capacitor, 100µF, 50V	C1243
C4	Capacitor, 2200µF, 15V	C1148
C5	Capacitor, 470pF	C0342
C6	Capacitor, .05µF, 12V	C0572
C7	Capacitor, 470pF	C0342
C8	Capacitor, .01µF, 500V	C0423
CR1	Diode, 1N4005	CR0284
CR2	Diode, 1N4005	CR0284
CR3	Diode, 1N4005	CR0284
CR4	Diode, 1N4005	CR0284
CR5	Diode, 1N4005	CR0284
CR6	Diode, 1N4005	CR0284
CR7	Diode, 1N4005	CR0284
CR8	Diode, 1N4005	CR0284
CR9	Diode, 1N4005	CR0284
CR10	Diode, 1N4131	CR0150
L1	Inductor, 100uH, 20%	L0166
L2	Inductor, 100uH, 20%	L0166
Q1	Transistor, 2N4921	Q0267
Q2	Transistor, 2N3906	Q0246
Q3	Transistor, 2N3906	Q0246
Q4	Transistor, 2N4921	Q0267
Q5	Transistor, 2N3906	Q0246
Q6	Transistor, 2N3906	Q0246
Q7	Transistor, 2N4921	Q0267
Q8	Transistor, 2N1565	Q0137
Q9	Transistor, 2N5190	Q0281
Q10	Transistor, 2N3646	Q0118
Q11	Transistor, 2N4921	Q0267
R1	Resistor, 4.7Ω, 1/4W, 5%	R0892
R2	Resistor, VAR., 1K	R2190
R3	Resistor, 4.7Ω, 1/4W, 5%	R0892
R4	Resistor, VAR., 10K	R2193
R5	Resistor, 10K, 1/4W, 5%	R0768

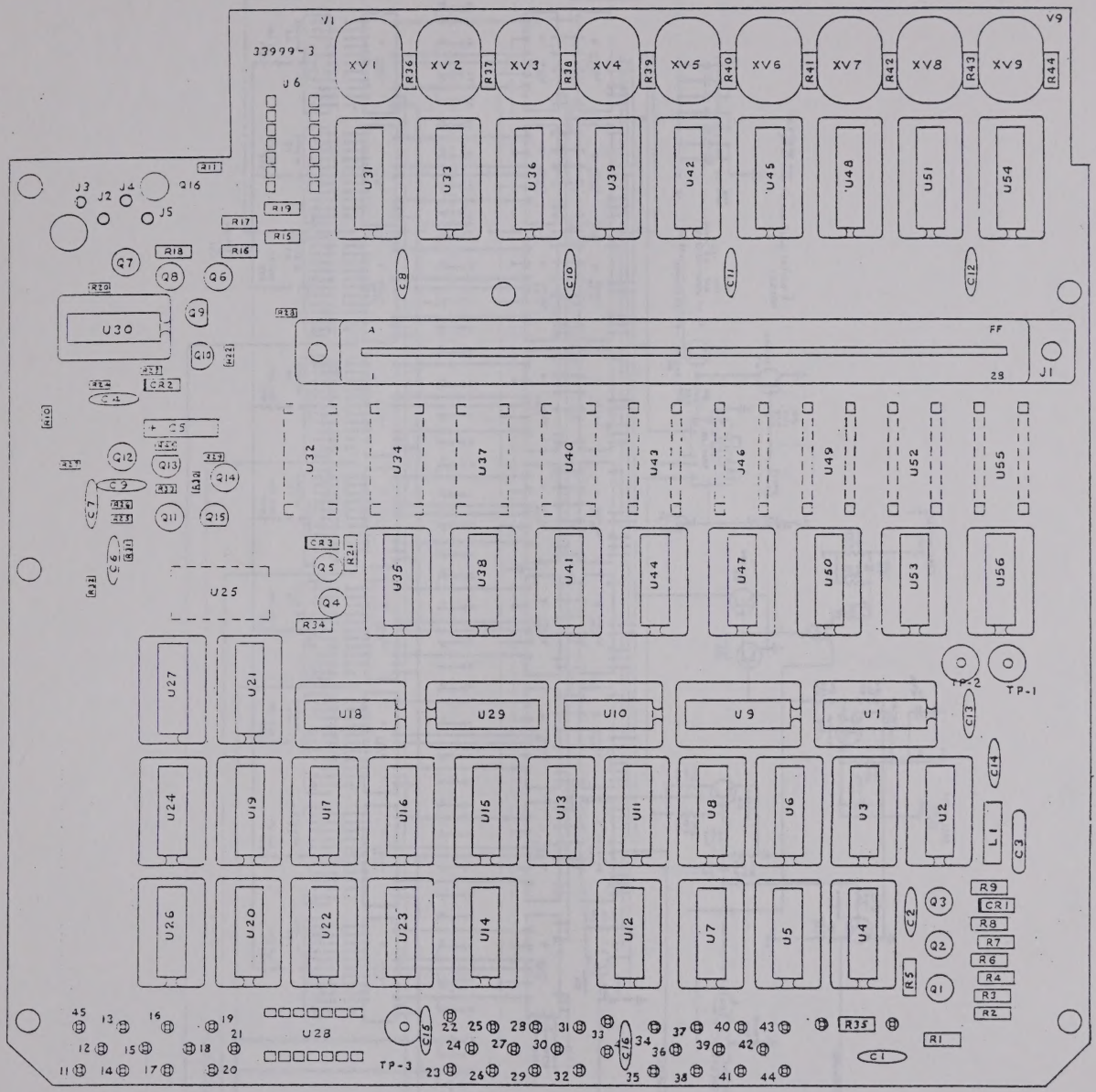
REF	DESCRIPTION	SD PART NO
R6	Resistor, 3.3K, 1/4W, 5%	R0742
R7	Resistor, 6.8K, 1/4W, 5%	R0696
R8	Resistor, 10K, 1/4W, 5%	R0766
R9	Resistor, 6.8K, 1/4W, 5%	R0696
R10	Resistor, 3.3K, 1/4W, 5%	R0742
R11	Resistor, 2.2K, 1/4W, 5%	R0794
R12	Resistor, 4.7K, 1/4W, 5%	R0892
R13	Resistor, VAR., 1K	R2390
R14	Resistor, 4.7K, 1/4W, 5%	R0892
R15	Resistor, 1.5K, 1/4W, 5%	R0783
R16	Resistor, 10K, 1/4W, 5%	R0766
R17	Resistor, VAR., 1K	R2390
R18	Resistor, 5.1K, 1/4W, 5%	R0693
R19	Resistor, 4.7K, 1/4W, 5%	R0892
R20	Resistor, 3.3K, 1/4W, 5%	R0742
R21	Resistor, 6.8K, 1/4W, 5%	R0696
R22	Resistor, 33K, 1/4W, 5%	R0780
U1	Integrated Circuit, µ723C	25756
U2	Integrated Circuit, µ723C	25756
U3	Integrated Circuit, CA3018	25720



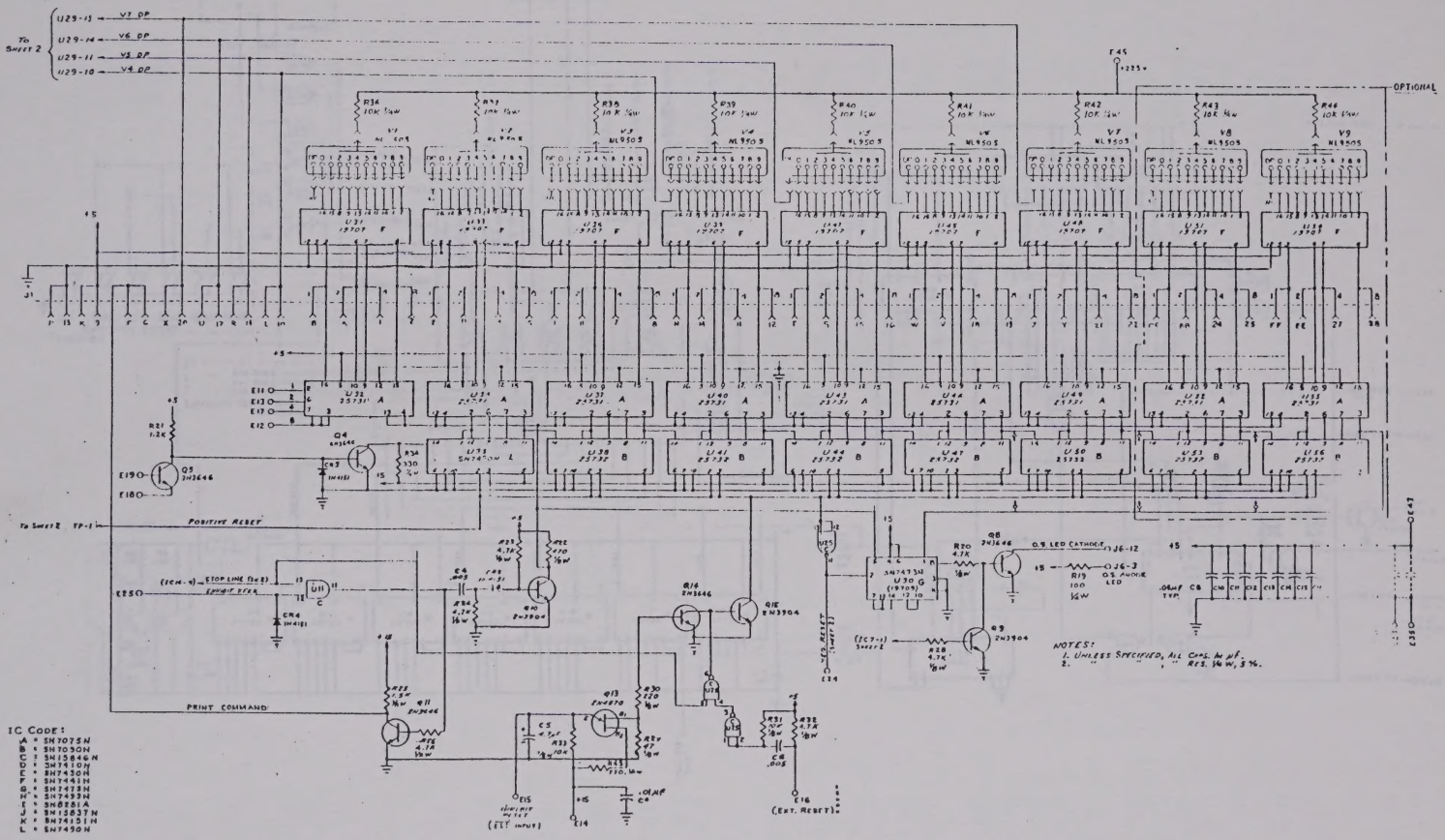
A2, SHIELD BOARD ASSEMBLY, C39448R2

A2 SHIELD PARTS LIST

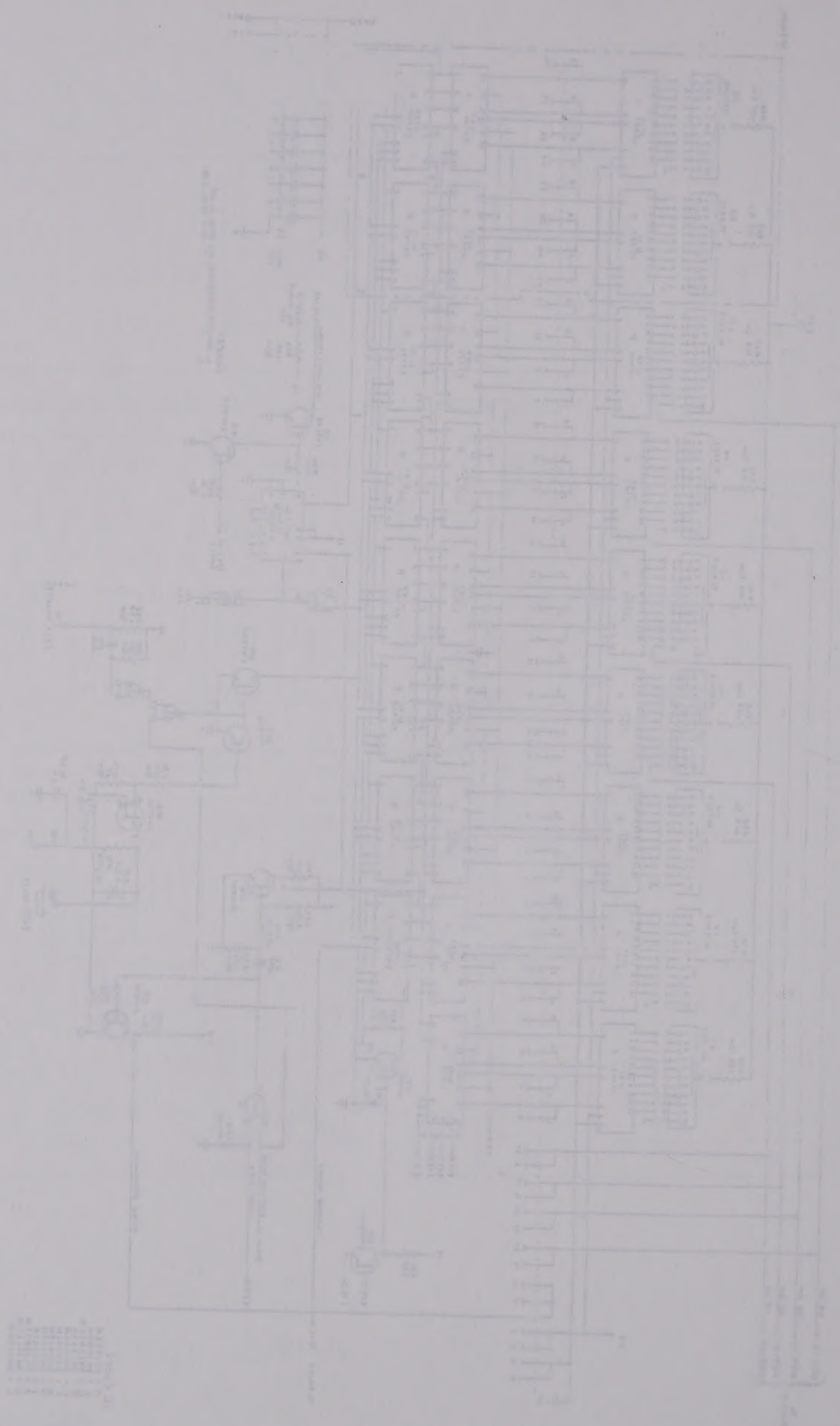
REF	DESCRIPTION	SD PART NO.
	A2 Shield P.C. Assembly	C39448R2
	A2 Shield Schematic	P/O D39100R3
S1	Switch, Pushbutton, 7 STA W/Buttons	S0392
S2	Switch, Pushbutton, 7 STA W/Buttons	S0392
S3	Switch, Pushbutton, 7 STA W/Buttons	S0392
S4	Switch, Pushbutton, 7 STA W/Buttons	S0392
S5	Switch, Pushbutton, 7 STA W/Buttons	S0392
S6	Switch, Pushbutton, 7 STA W/Buttons	S0392
S7	Switch, Pushbutton, 7 STA W/Buttons	S0392

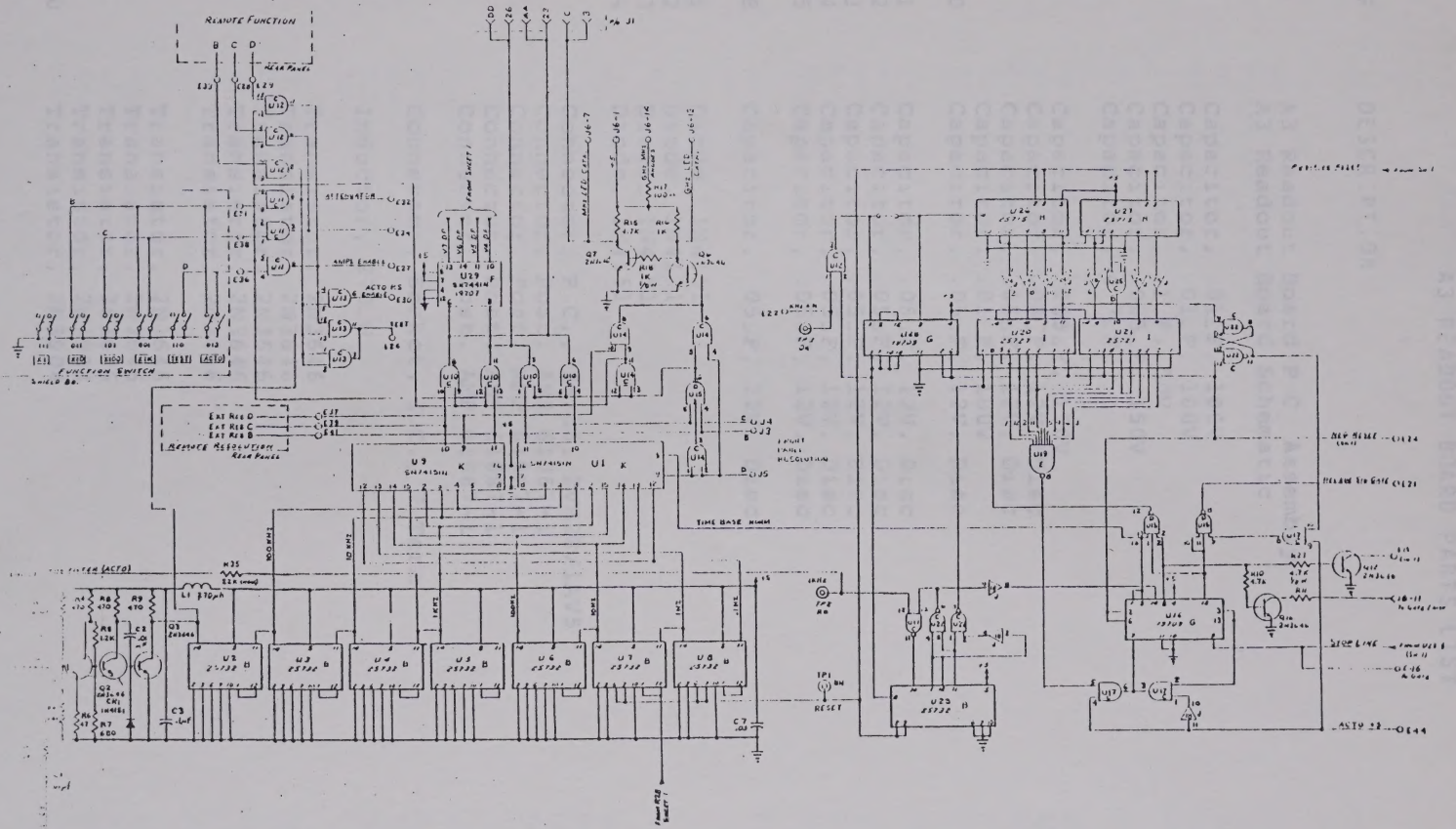


. READOUT P.C. ASSEMBLY, D39000R2



A3, READOUT SCHEMATIC, SHEET 1 OF 2, D33997R4





A3, READOUT SCHEMATIC, SHEET 2 OF 2, D33997R4

CA, KEYBOARD SCHEMATIC, SHEET 5 OF 5, D23BAM4

A3 READOUT BOARD PARTS LIST

REF	DESCRIPTION	SD PART NO.
	A3 Readout Board P.C. Assembly	D39000R2
	A3 Readout Board Schematic	D33997R4
C1	Capacitor, .01μF, 100V	C0556
C2	Capacitor, .01μF, 100V	C0556
C3	Capacitor, .1μF, 50V	C0881
C4	Capacitor, .005μF, 150V	C0325
C5	Capacitor, 4.7μF	C0406
C6	Capacitor, .005μF, 150V	C0325
C7	Capacitor, .05μF, 12V, Disc	C0672
C8	Capacitor, .05μF, 12V, Disc	C0672
C9	Capacitor, .01μF, 100V	C0556
C10	Capacitor, .05μF, 12V, Disc	C0672
C11	Capacitor, .05μF, 12V, Disc	C0672
C12	Capacitor, .05μF, 12V, Disc	C0672
C13	Capacitor, .05μF, 12V, Disc	C0672
C14	Capacitor, .05μF, 12V, Disc	C0672
C15	Capacitor, .05μF, 12V, Disc	C0672
C16	Capacitor, .05μF, 12V, Disc	C0672
CR1	Diode, 1N4151	CR0150
CR2	Diode, 1N4151	CR0150
CR3	Diode, 1N4151	CR0150
CR4	Diode, 1N4151	CR0150
J1	Connector, P.C., 28/56, 2VH28/1AV5	09060600
J2	Connector, Post, AMP 61067-1	E0318
J3	Connector, Post, AMP 61067-1	E0318
J4	Connector, Post, AMP 61067-1	E0318
J5	Connector, Post, AMP 61067-1	E0318
J6	Connector, Socket, I.C., 7 Term	X0184
L1	Inductor, 270μH	L0067
Q1	Transistor, 2N3646	Q0218
Q2	Transistor, 2N3646	Q0218
Q3	Transistor, 2N3646	Q0218
Q4	Transistor, 2N3646	Q0218
Q5	Transistor, 2N3646	Q0218
Q6	Transistor, 2N3646	Q0218
Q7	Transistor, 2N3646	Q0218
Q8	Transistor, 2N3646	Q0218
Q9	Transistor, 2N3904	Q0247
Q10	Transistor, 2N3904	Q0247

REF	DESCRIPTION	SD PART NO.
Q11	Transistor, 2N3646	Q0218
Q12	Transistor, 2N3646	Q0218
Q13	Transistor, 2N4870	Q0266
Q14	Transistor, 2N3646	Q0218
Q15	Transistor, 2N3904	Q0247
Q16	Transistor, 2N3646	Q0218
R1	Resistor, 1K, 1/4W, 5%	R0765
R2	Resistor, 1.8K, 1/4W, 5%	R0959
R3	Resistor, 6.8K, 1/4W, 5%	R0696
R4	Resistor, 470Ω, 1/4W, 5%	R1044
R5	Resistor, 1.2K, 1/4W, 5%	R0809
R6	Resistor, 47Ω, 1/4W, 5%	R0743
R7	Resistor, 680Ω, 1/4W, 5%	R1234
R8	Resistor, 470Ω, 1/4W, 5%	R1044
R9	Resistor, 470Ω, 1/4W, 5%	R1044
R10	Resistor, 4.7K, 1/8W, 5%	R1733
R11	Resistor, Factory Selected	Rxxxx
R12	Not Used	
R13	Not Used	
R14	Not Used	
R15	Resistor, 4.7K, 1/4W, 5%	R0892
R16	Resistor, 1K, 1/4W, 5%	R0765
R17	Resistor, 100Ω, 1/4W, 5%	R0966
R18	Resistor, 1K, 1/4W, 5%	R0765
R19	Resistor, 100Ω, 1/4W, 5%	R0966
R20	Resistor, 4.7K, 1/8W, 5%	R1733
R21	Resistor, 1.2K, 1/4W, 5%	R0809
R22	Resistor, 470Ω, 1/8W, 5%	R1451
R23	Resistor, 4.7K, 1/8W, 5%	R1733
R24	Resistor, 4.7K, 1/8W, 5%	R1733
R25	Resistor, 1.5K, 1/8W, 5%	R2463
R26	Resistor, 4.7K, 1/8W, 5%	R1733
R27	Resistor, 4.7K, 1/8W, 5%	R1733
R28	Resistor, 4.7K, 1/8W, 5%	R1733
R29	Resistor, 47Ω, 1/8W, 5%	R1449
R30	Resistor, 2[illegible]Ω, 1/8W, 5%	R1743
R31	Resistor, 10K, 1/8W, 5%	R1437
R32	Resistor, 4.7K, 1/8W, 5%	R1733
R33	Resistor, 10K, 1/8W, 5%	R1437
R34	Resistor, 330Ω, 1/4W, 5%	R0662
[illegible]	[illegible], 22K, 1/4W, 5%	R0768

REF	DESCRIPTION	SD PART NO.
R36	Resistor, 10K, 1/4W, 5%	R0766
R37	Resistor, 10K, 1/4W, 5%	R0766
R38	Resistor, 10K, 1/4W, 5%	R0766
R39	Resistor, 10K, 1/4W, 5%	R0766
R40	Resistor, 10K, 1/4W, 5%	R0766
R41	Resistor, 10K, 1/4W, 5%	R0766
R42	Resistor, 10K, 1/4W, 5%	R0766
R43	Resistor, 10K, 1/4W, 5%	R0766
R44	Resistor, 10K, 1/4W, 5%	R0766
R45	Resistor, 220Ω, 1/8W, 5%	R1743
U1	Integrated Circuit, SN74151N	
U2	Integrated Circuit, SN7090N	25732
U3	Integrated Circuit, SN7090N	25732
U4	Integrated Circuit, SN7090N	25732
U5	Integrated Circuit, SN7090N	25732
U6	Integrated Circuit, SN7090N	25732
U7	Integrated Circuit, SN7090N	25732
U8	Integrated Circuit, SN7090N	25732
U9	Integrated Circuit, SN74151N	
U10	Integrated Circuit, SN15846	19716
U11	Integrated Circuit, SN15846	19716
U12	Integrated Circuit, SN15846	19716
U13	Integrated Circuit, SN15846	19716
U14	Integrated Circuit, SN15846	19716
U15	Integrated Circuit, SN7410N	19706
U16	Integrated Circuit, SN7473N	19709
U17	Integrated Circuit, SN15846	19716
U18	Integrated Circuit, SN15837N	25728
U19	Integrated Circuit, SN7430N	25726
U20	Integrated Circuit, SN8281A	25727
U21	Integrated Circuit, SN8281A	25727
U22	Integrated Circuit, SN15846	19716
U23	Integrated Circuit, SN7090N	25732
U24	Integrated Circuit, SN15837N	25728
U25	Integrated Circuit, SN15846	19716
U26	Integrated Circuit, SN7493N	25715
U27	Integrated Circuit, SN7493N	25715
U28	Integrated Circuit, SN7473N	19709
U29	Integrated Circuit, SN7441N	19707
U30	Integrated Circuit, SN7473N	19709

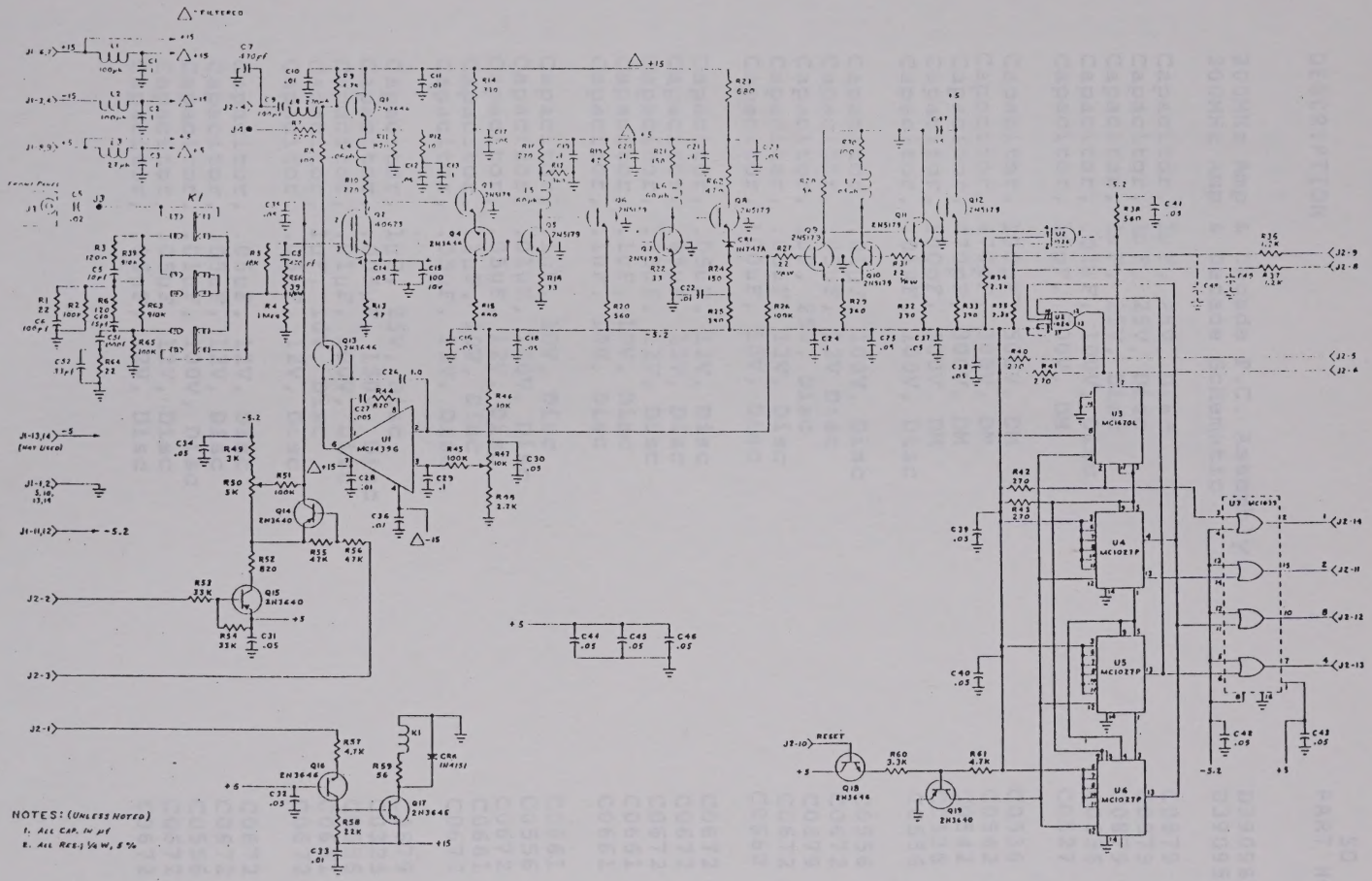
REF.	DESCRIPTION	SD PART NO.
U31	Integrated Circuit, SN7441N	19707
U32	Integrated Circuit, SN7075N	25731
U33	Integrated Circuit, SN7441N	19707
U34	Integrated Circuit, SN7075N	25731
U35	Integrated Circuit, SN7490N	19711
U36	Integrated Circuit, SN7441N	19707
U37	Integrated Circuit, SN7075N	25731
U38	Integrated Circuit, SN7090N	25732
U39	Integrated Circuit, SN7441N	19707
U40	Integrated Circuit, SN7075N	25731
U41	Integrated Circuit, SN7090N	25732
U42	Integrated Circuit, SN7441N	19707
U43	Integrated Circuit, SN7075N	25731
U44	Integrated Circuit, SN7090N	25732
U45	Integrated Circuit, SN7441N	19707
U46	Integrated Circuit, SN7075N	25731
U47	Integrated Circuit, SN7090N	25732
U48	Integrated Circuit, SN7441N	19707
U49	Integrated Circuit, SN7075N	25731
U50	Integrated Circuit, SN7090N	25732
U51	Integrated Circuit, SN7441N	19707
U52	Integrated Circuit, SN7075N	25731
U53	Integrated Circuit, SN7090N	25732
U54	Integrated Circuit, SN7441N	19707
U55	Integrated Circuit, SN7075N	25731
U56	Integrated Circuit, SN7090N	25732
V1	Tube, Readout, NL5859S	V0131
V2	Tube, Readout, NL5859S	V0131
V3	Tube, Readout, NL5859S	V0131
V4	Tube, Readout, NL5859S	V0131
V5	Tube, Readout, NL5859S	V0131
V6	Tube, Readout, NL5859S	V0131
V7	Tube, Readout, NL5859S	V0131
V8	Tube, Readout, NL5859S	V0131
V9	Tube, Readout, NL5859S	V0131
XU1	Integrated Circuit Socket, 8 Term	X0185
XU2	Integrated Circuit Socket, 7 Term	X0184
XU3	Integrated Circuit Socket, 7 Term	X0184
XU4	Integrated Circuit Socket, 7 Term	X0184
XU5	Integrated Circuit Socket, 7 Term	X0184

REF	DESCRIPTION	SD PART NO.
XU6	Integrated Circuit Socket, 7 Term	X0184
XU7	Integrated Circuit Socket, 7 Term	X0184
XU8	Integrated Circuit Socket, 7 Term	X0184
XU9	Integrated Circuit Socket, 8 Term	X0185
XU10	Integrated Circuit Socket, 7 Term	X0184
XU11	Integrated Circuit Socket, 7 Term	X0184
XU12	Integrated Circuit Socket, 7 Term	X0184
XU13	Integrated Circuit Socket, 7 Term	X0184
XU14	Integrated Circuit Socket, 7 Term	X0184
XU15	Integrated Circuit Socket, 7 Term	X0184
XU16	Integrated Circuit Socket, 7 Term	X0184
XU17	Integrated Circuit Socket, 7 Term	X0184
XU18	Integrated Circuit Socket, 7 Term	X0184
XU19	Integrated Circuit Socket, 7 Term	X0184
XU20	Integrated Circuit Socket, 7 Term	X0184
XU21	Integrated Circuit Socket, 7 Term	X0184
XU22	Integrated Circuit Socket, 7 Term	X0184
XU23	Integrated Circuit Socket, 7 Term	X0184
XU24	Integrated Circuit Socket, 7 Term	X0184
XU25	Integrated Circuit Socket, 7 Term	X0184
XU26	Integrated Circuit Socket, 7 Term	X0184
XU27	Integrated Circuit Socket, 7 Term	X0184
XU28	Integrated Circuit Socket, 7 Term	X0184
XU29	Integrated Circuit Socket, 8 Term	X0185
XU30	Integrated Circuit Socket, 7 Term	X0184
XU31	Integrated Circuit Socket, 8 Term	X0185
XU32	Integrated Circuit Socket, 8 Term	X0185
XU33	Integrated Circuit Socket, 8 Term	X0185
XU34	Integrated Circuit Socket, 8 Term	X0185
XU35	Integrated Circuit Socket, 7 Term	X0184
XU36	Integrated Circuit Socket, 8 Term	X0185
XU37	Integrated Circuit Socket, 8 Term	X0185
XU38	Integrated Circuit Socket, 7 Term	X0184
XU39	Integrated Circuit Socket, 8 Term	X0185
XU40	Integrated Circuit Socket, 8 Term	X0185
XU41	Integrated Circuit Socket, 7 Term	X0184
XU42	Integrated Circuit Socket, 8 Term	X0185
XU43	Integrated Circuit Socket, 8 Term	X0185
XU44	Integrated Circuit Socket, 7 Term	X0184
XU45	Integrated Circuit Socket, 8 Term	X0185

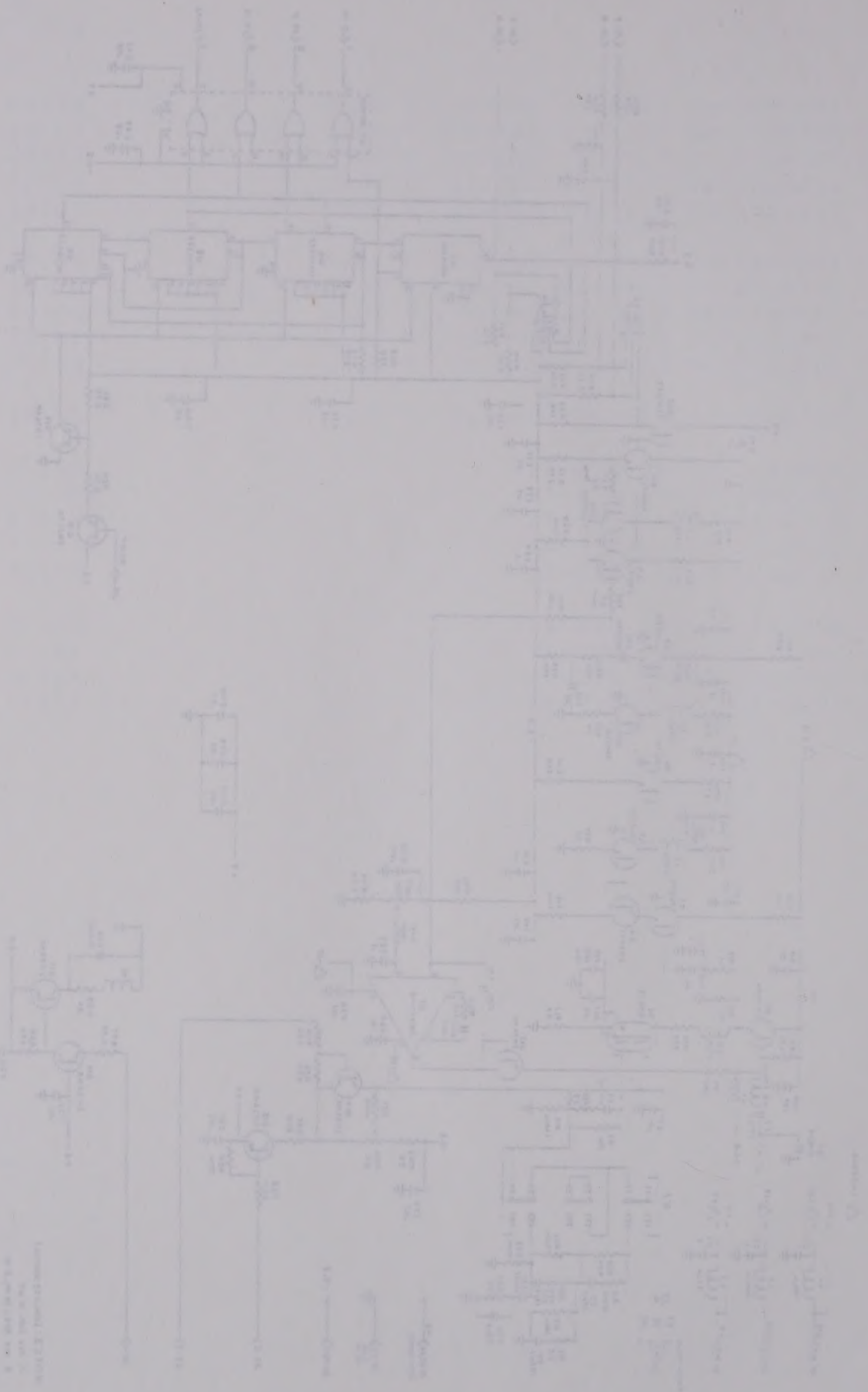
REF	DESCRIPTION	PART NO.
XU6	Integrated Circuit Socket, 7 Term	X0184
XU7	Integrated Circuit Socket, 7 Term	X0184
XU8	Integrated Circuit Socket, 7 Term	X0184
XU9	Integrated Circuit Socket, 8 Term	X0185
XU10	Integrated Circuit Socket, 7 Term	X0184
XU11	Integrated Circuit Socket, 7 Term	X0184
XU12	Integrated Circuit Socket, 7 Term	X0184
XU13	Integrated Circuit Socket, 7 Term	X0184
XU14	Integrated Circuit Socket, 7 Term	X0184
XU15	Integrated Circuit Socket, 7 Term	X0184
XU16	Integrated Circuit Socket, 7 Term	X0184
XU17	Integrated Circuit Socket, 7 Term	X0184
XU18	Integrated Circuit Socket, 7 Term	X0184
XU19	Integrated Circuit Socket, 7 Term	X0184
XU20	Integrated Circuit Socket, 7 Term	X0184
XU21	Integrated Circuit Socket, 7 Term	X0184
XU22	Integrated Circuit Socket, 7 Term	X0184
XU23	Integrated Circuit Socket, 7 Term	X0184
XU24	Integrated Circuit Socket, 7 Term	X0184
XU25	Integrated Circuit Socket, 7 Term	X0184
XU26	Integrated Circuit Socket, 7 Term	X0184
XU27	Integrated Circuit Socket, 7 Term	X0184
XU28	Integrated Circuit Socket, 7 Term	X0184
XU29	Integrated Circuit Socket, 8 Term	X0185
XU30	Integrated Circuit Socket, 7 Term	X0184
XU31	Integrated Circuit Socket, 8 Term	X0185
XU32	Integrated Circuit Socket, 8 Term	X0185
XU33	Integrated Circuit Socket, 8 Term	X0185
XU34	Integrated Circuit Socket, 8 Term	X0185
XU35	Integrated Circuit Socket, 7 Term	X0184
XU36	Integrated Circuit Socket, 8 Term	X0185
XU37	Integrated Circuit Socket, 8 Term	X0185
XU38	Integrated Circuit Socket, 7 Term	X0184
XU39	Integrated Circuit Socket, 8 Term	X0185
XU40	Integrated Circuit Socket, 8 Term	X0185
XU41	Integrated Circuit Socket, 7 Term	X0184
XU42	Integrated Circuit Socket, 8 Term	X0185
XU43	Integrated Circuit Socket, 8 Term	X0185
XU44	Integrated Circuit Socket, 7 Term	X0184
XU45	Integrated Circuit Socket, 8 Term	X0185

REF	DESCRIPTION	SD PART NO.
XU46	Integrated Circuit Socket, 8 Term	X0185
XU47	Integrated Circuit Socket, 7 Term	X0184
XU48	Integrated Circuit Socket, 8 Term	X0185
XU49	Integrated Circuit Socket, 8 Term	X0185
XU50	Integrated Circuit Socket, 7 Term	X0184
XU51	Integrated Circuit Socket, 8 Term	X0185
XU52	Integrated Circuit Socket, 8 Term	X0185
XU53	Integrated Circuit Socket, 7 Term	X0184
XU54	Integrated Circuit Socket, 8 Term	X0185
XU55	Integrated Circuit Socket, 8 Term	X0185
XU56	Integrated Circuit Socket, 7 Term	X0184
XV1	Socket, Tube, RTS-44	X0179
XV2	Socket, Tube, RTS-44	X0179
XV3	Socket, Tube, RTS-44	X0179
XV4	Socket, Tube, RTS-44	X0179
XV5	Socket, Tube, RTS-44	X0179
XV6	Socket, Tube, RTS-44	X0179
XV7	Socket, Tube, RTS-44	X0179
XV8	Socket, Tube, RTS-44	X0179
XV9	Socket, Tube, RTS-44	X0179

REF	DESCRIPTION	PART NO.
XU46	Integrated Circuit Socket, 8 Term	X0185
XU47	Integrated Circuit Socket, 7 Term	X0184
XU48	Integrated Circuit Socket, 8 Term	X0185
XU49	Integrated Circuit Socket, 8 Term	X0185
XU50	Integrated Circuit Socket, 7 Term	X0184
XU51	Integrated Circuit Socket, 8 Term	X0185
XU52	Integrated Circuit Socket, 8 Term	X0185
XU53	Integrated Circuit Socket, 7 Term	X0184
XU54	Integrated Circuit Socket, 8 Term	X0185
XU55	Integrated Circuit Socket, 8 Term	X0185
XU56	Integrated Circuit Socket, 7 Term	X0184
XV1	Socket, Tube, MTS-44	X0179
XV2	Socket, Tube, MTS-44	X0179
XV3	Socket, Tube, MTS-44	X0179
XV4	Socket, Tube, MTS-44	X0179
XV5	Socket, Tube, MTS-44	X0179
XV6	Socket, Tube, MTS-44	X0179
XV7	Socket, Tube, MTS-44	X0179
XV8	Socket, Tube, MTS-44	X0179
XV9	Socket, Tube, MTS-44	X0179



A4, 200MHz AMP & DECADE SCHEMATIC, D39095R4



A4 200MHz AMP & DECADE PARTS LIST

REF.	DESCRIPTION	SD PART NO.
	200MHz Amp & Decade P.C. Assembly	D39098R5
	200MHz Amp & Decade Schematic	D39095R4
C1	Capacitor, 1µF, 25V, Disc	C0879
C2	Capacitor, 1µF, 25V, Disc	C0879
C3	Capacitor, 1µF, 25V, Disc	C0879
C4	Capacitor, .01µF, 100V, Disc	C0556
C5	Capacitor, 10pF, 500V, DM	C0527
C6	Capacitor, 100pF, 500V, DM	C0536
C7	Capacitor, 470pF, 300V, DM	C0542
C8	Capacitor, 470pF, 300V, DM	C0542
C9	Capacitor, 100pF, 500V, DM	C0536
C10	Capacitor, .01µF, 100V, Disc	C0556
C11	Capacitor, .01µF, 100V, Disc	C0556
C12	Capacitor, .05µF, 12V Disc	C0672
C13	Capacitor, 1µF, 25V, Disc	C0879
C14	Capacitor, .05µF, 12V, Disc	C0672
C15	Capacitor, 100µF, 10V, Disc	C0660
C16	Capacitor, .05µF, 12V, Disc	C0672
C17	Capacitor, .05µF, 12V, Disc	C0672
C18	Capacitor, .05µF, 12V, Disc	C0672
C19	Capacitor, .1µF, 10V, Disc	C0661
C20	Capacitor, .1µF, 10V, Disc	C0661
C21	Capacitor, .1µF, 10V, Disc	C0661
C22	Capacitor, .01µF, 100V, Disc	C0556
C23	Capacitor, .05µF, 12V, Disc	C0672
C24	Capacitor, .1µF, 10V, Disc	C0661
C25	Capacitor, .05µF, 12V, Disc	C0672
C26	Capacitor, 1µF, 25V, Disc	C0879
C27	Capacitor, .005µF, 150V, Disc	C0325
C28	Capacitor, .01µF, 100V, Disc	C0556
C29	Capacitor, 1µF, 10V, Disc	C0661
C30	Capacitor, .05µF, 12V, Disc	C0672
C31	Capacitor, .05µF, 12V, Disc	C0672
C32	Capacitor, .05µF, 12V, Disc	C0672
C33	Capacitor, .01µF, 100V, Disc	C0556
C34	Capacitor, .05µF, 12V, Disc	C0672
C35	Capacitor, .05µF, 12V, Disc	C0672

REF.	DESCRIPTION	SD PART NO.
C36	Capacitor, .01μF, 100V, Disc	C0556
C37	Capacitor, .05μF, 12V, Disc	C0672
C38	Capacitor, .05μF, 12V, Disc	C0672
C39	Capacitor, .05μF, 12V, Disc	C0672
C40	Capacitor, .05μF, 12V, Disc	C0672
C41	Capacitor, .05μF, 12V, Disc	C0672
C42	Capacitor, .05μF, 12V, Disc	C0672
C43	Capacitor, .05μF, 12V, Disc	C0672
C44	Capacitor, .05μF, 12V, Disc	C0672
C45	Capacitor, .05μF, 12V, Disc	C0672
C46	Capacitor, .05μF, 12V, Disc	C0672
C47	Capacitor, .05μF, 12V, Disc	C0672
C48	Capacitor, Selected	Cxxxx
C49	Capacitor, Selected	Cxxxx
CR1	Diode, 1N747A	CR5005
CR2	Not Used	
CR3	Not Used	
CR4	Not Used	
CR5	Not Used	
CR6	Diode, 1N4151	CR0150
J1	Integrated Circuit Socket, 14 Pin	X0186
J2	Integrated Circuit Socket, 14 Pin	X0186
J3	Connector, Post, AMP 61067-1	E0318
J4	Connector, Post, AMP 61067-1	E0318
K1	Relay, Printact #12BP3G	Kxxxx
L1	Inductor, 100μH	L0073
L2	Inductor, 100μH	L0073
L3	Inductor, 27μH	L0076
L4	Inductor, .06μH	L0158
L5	Inductor, .06μH	L0158
L6	Inductor, .06μH	L0158
L7	Inductor, .06μH	L0158
Q1	Transistor, 2N3646	Q0218
Q2	Transistor, 40673	Q0297
Q3	Transistor, 2N5179	Q0269
Q4	Transistor, 2N3646	Q0218
Q5	Transistor, 2N5179	Q0269

A6 200MHz AMP & DECADE PARTS LIST (Cont'd)

REF.	DESCRIPTION	PART NO.
C38	Capacitor, .01uF, 100V, Disc	C0556
C39	Capacitor, .05uF, 12V, Disc	C0572
C40	Capacitor, .05uF, 12V, Disc	C0572
C41	Capacitor, .05uF, 12V, Disc	C0572
C42	Capacitor, .05uF, 12V, Disc	C0572
C43	Capacitor, .05uF, 12V, Disc	C0572
C44	Capacitor, .05uF, 12V, Disc	C0572
C45	Capacitor, .05uF, 12V, Disc	C0572
C46	Capacitor, .05uF, 12V, Disc	C0572
C47	Capacitor, .05uF, 12V, Disc	C0572
C48	Capacitor, Selected	C0000
C49	Capacitor, Selected	
CR1	Diode, 1N4147A	CR5000
CR2	Not Used	
CR3	Not Used	
CR4	Not Used	
CR5	Not Used	
CR6	Diode, 1N4151	CR0189
J1	Integrated Circuit Socket, 14 Pin	X0188
J2	Integrated Circuit Socket, 14 Pin	X0188
J3	Connector, Post, AMP 61067-1	E0318
J4	Connector, Post, AMP 61067-1	E0318
K1	Relay, Printed Circuit	K0000
L1	Inductor, 100uH	L0073
L2	Inductor, 100uH	L0073
L3	Inductor, 47uH	L0076
L4	Inductor, .05uH	L0158
L5	Inductor, .05uH	L0158
L6	Inductor, .05uH	L0158
L7	Inductor, .05uH	L0158
Q1	Transistor, 2N3646	Q0248
Q2	Transistor, 40673	Q0297
Q3	Transistor, 2N5179	Q0269
Q4	Transistor, 2N3646	Q0218
Q5	Transistor, 2N5179	Q0269

REF.	DESCRIPTION	SD PART NO.
Q6	Transistor, 2N5179	Q0269
Q7	Transistor, 2N5179	Q0269
Q8	Transistor, 2N5179	Q0269
Q9	Transistor, 2N5179	Q0269
Q10	Transistor, 2N5179	Q0269
Q11	Transistor, 2N5179	Q0269
Q12	Transistor, 2N5179	Q0269
Q13	Transistor, 2N3646	Q0218
Q14	Transistor, 2N3640	Q0178
Q15	Transistor, 2N3640	Q0178
Q16	Transistor, 2N3646	Q0218
Q17	Transistor, 2N3645	Q0215
Q18	Transistor, 2N3646	Q0218
R1	Resistor, 22Ω, 1/4W, 5%	R1436
R2	Resistor, 100K, 1/4W, 5%	R0741
R3	Resistor, 120Ω, 1/4W, 5%	R1461
R4	Resistor, 1MΩ, 1/4W, 5%	R0692
R5	Resistor, 10K, 1/4W, 5%	R0766
R6	Resistor, 120Ω, 1/4W, 5%	R1461
R7	Resistor, 220Ω, 1/4W, 5%	R0760
R8	Resistor, 100Ω, 1/4W, 5%	R0966
R9	Resistor, 4.7K, 1/4W, 5%	R0892
R10	Resistor, 220Ω, 1/4W, 5%	R0760
R11	Resistor, 820Ω, 1/4W, 5%	R0762
R12	Resistor, 10Ω, 1/4W, 5%	R0739
R13	Resistor, 47Ω, 1/4W, 5%	R0743
R14	Resistor, 330Ω, 1/4W, 5%	R0662
R15	Resistor, 680Ω, 1/4W, 5%	R1234
R16	Resistor, 270Ω, 1/4W, 5%	R0694
R17	Resistor, 360Ω, 1/4W, 5%	R1571
R18	Resistor, 33Ω, 1/4W, 5%	R1550
R19	Resistor, 47Ω, 1/4W, 5%	R0743
R20	Resistor, 560Ω, 1/4W, 5%	R0819
R21	Resistor, 150Ω, 1/4W, 5%	R0983
R22	Resistor, 33Ω, 1/4W, 5%	R1550
R23	Resistor, 680Ω, 1/4W, 5%	R1234
R24	Resistor, 150Ω, 1/4W, 5%	R0983
R25	Resistor, 390Ω, 1/4W, 5%	R0880

REF	DESCRIPTION	SD PART NO.
R26	Resistor, 100K, 1/4W, 5%	R0741
R27	Resistor, 22Ω, 1/8W, 5%	R1448
R28	Resistor, 56Ω, 1/4W, 5%	R1554
R29	Resistor, 360Ω, 1/4W, 5%	R1571
R30	Resistor, 100Ω, 1/4W, 5%	R0966
R31	Resistor, 22Ω, 1/8W, 5%	R1448
R32	Resistor, 390Ω, 1/4W, 5%	R0880
R33	Resistor, 390Ω, 1/4W, 5%	R0880
R34	Resistor, 2.2K, 1/4W, 5%	R0794
R35	Resistor, 2.2K, 1/4W, 5%	R0794
R36	Resistor, 1.2K, 1/4W, 5%	R0809
R37	Resistor, 1.2K, 1/4W, 5%	R0809
R38	Resistor, 560Ω, 1/4W, 5%	R0819
R39	Resistor, 910K, 1/4W, 5%	R2312
R40	Resistor, 270Ω, 1/4W, 5%	R0694
R41	Resistor, 270Ω, 1/4W, 5%	R0694
R42	Resistor, 270Ω, 1/4W, 5%	R0694
R43	Resistor, 270Ω, 1/4W, 5%	R0694
R44	Resistor, 820Ω, 1/4W, 5%	R0762
R45	Resistor, 100K, 1/4W, 5%	R0741
R46	Resistor, 10K, 1/4W, 5%	R0766
R47	Resistor, 10K, Potentiometer, CTS 340	R2383
R48	Resistor, 2.2K, 1/4W, 5%	R0794
R49	Resistor, 3K, 1/4W, 5%	R0711
R50	Resistor, 5K, Potentiometer, CTS 340	R2187
R51	Resistor, 100K, 1/4W, 5%	R0741
R52	Resistor, 820Ω, 1/4W, 5%	R0762
R53	Resistor, 33K, 1/4W, 5%	R0780
R54	Resistor, 33K, 1/4W, 5%	R0780
R55	Resistor, 47K, 1/4W, 5%	R0777
R56	Resistor, 47K, 1/4W, 5%	R0777
R57	Resistor, 4.7K, 1/4W, 5%	R0892
R58	Resistor, 22K, 1/4W, 5%	R0768
R59	Resistor, 56Ω, 1/4W, 5%	R1554
R60	Resistor, 3.3K, 1/4W, 5%	R0742
R61	Resistor, 4.7K, 1/4W, 5%	R0892
R62	Resistor, 47Ω, 1/4W, 5%	R0743
U1	Integrated Circuit, MC1439G	25729
U2	Integrated Circuit, MC1026	

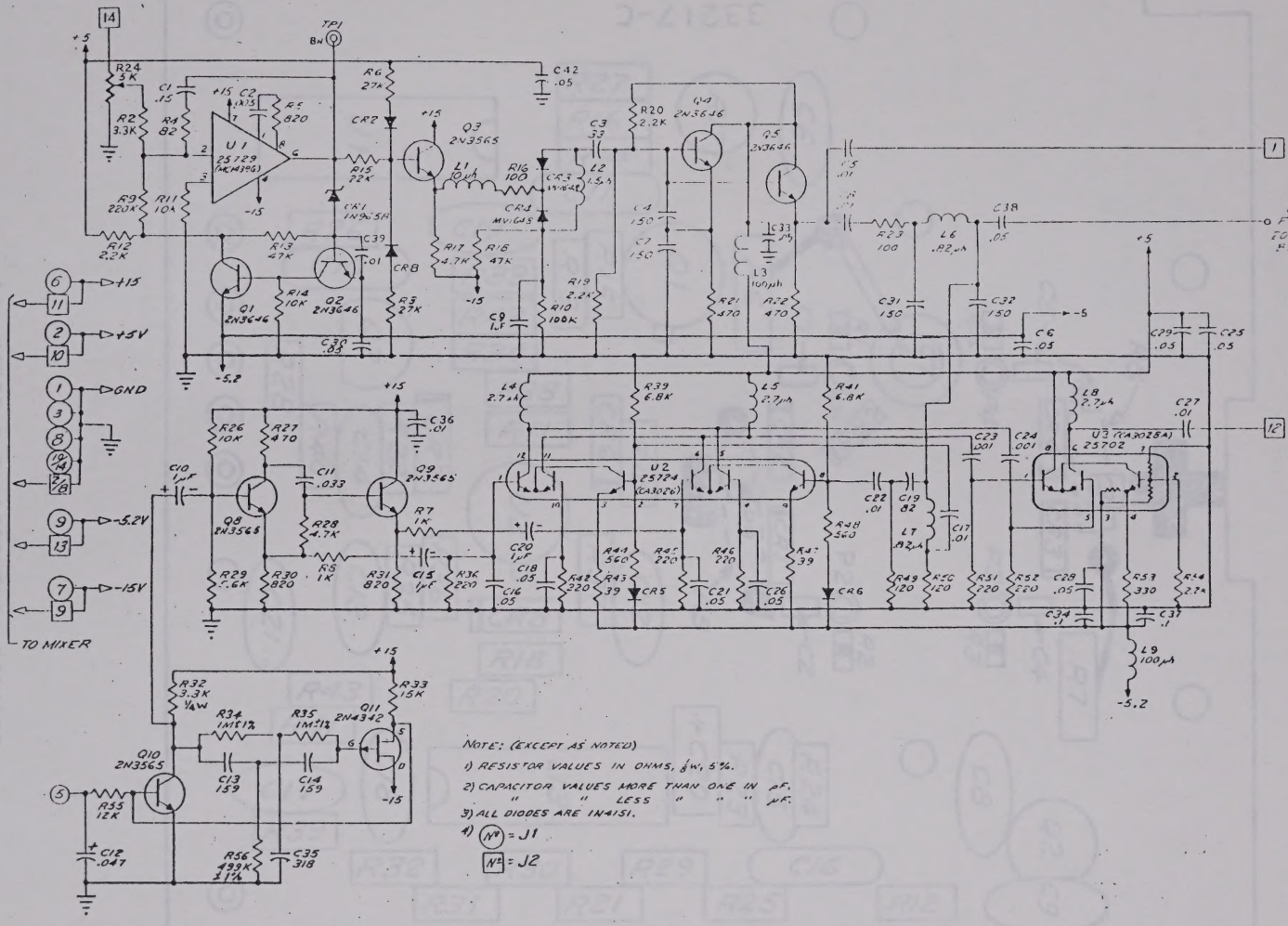
REF	DESCRIPTION	PART NO
U3	Integrated Circuit, MC1670L	25765
U4	Integrated Circuit, MC1027P	25719
U5	Integrated Circuit, MC1027P	25719
U6	Integrated Circuit, MC1027P	25719
U7	Integrated Circuit, MC1039	
C50	Capacitor, 15 pF, 500 V, DM	C0528
C51	Capacitor, 100 pF, 500 V, DM	C0536
C52	Capacitor, 33 pF, 500 V	C0877
Q19	Transistor, 2N3640	Q0178
R63	Resistor, 910 k, 1/4 W, 5%	R2312
R64	Resistor, 22 Ω, 1/4 W, 5%	R1436
R65	Resistor, 100 k, 1/4 W, 5%	R0741
R66	Resistor, 39 Ω, 1/8 W, 5%	R1829
XQ1	Not Used	
XQ2	Transistor Pad	H1838
XQ3	Transistor Pad	H1838
XQ4	Not Used	
XQ5	Transistor Pad	H1838
XQ6	Transistor Pad	H1838
XQ7	Transistor Pad	H1838
XQ8	Transistor Pad	H1838
XQ9	Transistor Pad	H1838
XQ10	Transistor Pad	H1838
XQ11	Transistor Pad	H1838
XQ12	Transistor Pad	H1838
XQ13	Not Used	
XQ14	Not Used	
XQ15	Not Used	
XQ16	Not Used	
XQ17	Transistor Pad	H0515

A5 ACTO PARTS LIST

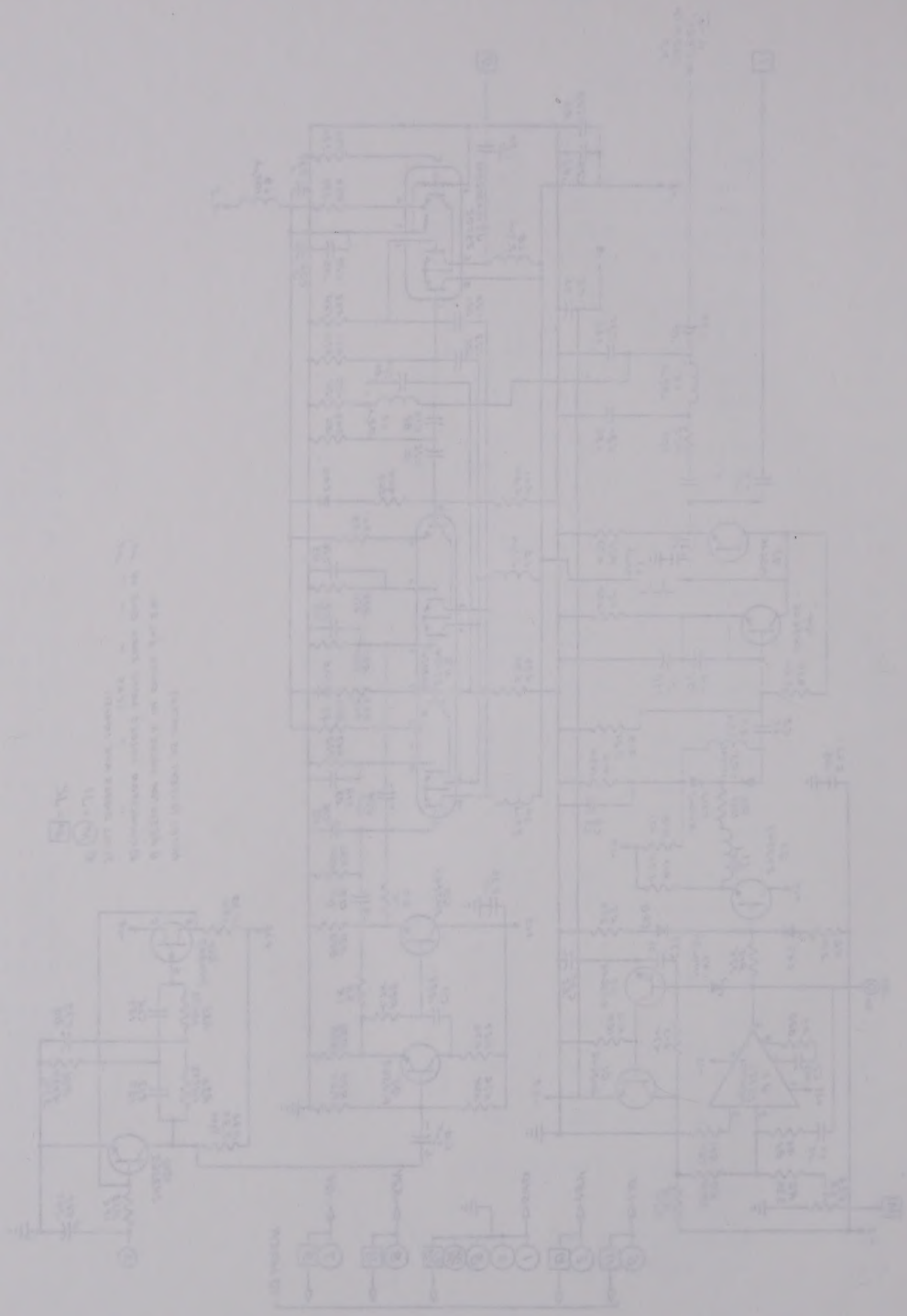
REF.	DESCRIPTION	SD PART NO.
	A5 ACTO P.C. Assembly	C39090
	A5 ACTO Schematic	C39087
C1	Capacitor, .15μF, 100V	C0237
C2	Capacitor, .005μF, 150V	C0325
C3	Capacitor, 33pF	C0531
C4	Capacitor, 150pF	C0537
C5	Capacitor, .01μF, 100V	C0556
C6	Capacitor, .05μF, 12V	C0672
C7	Capacitor, 150pF	C0537
C8	Capacitor, .01μF, 100V	C0556
C9	Capacitor, 1μF, 25V	C0879
C10	Capacitor, 1μF, 25V	C0879
C11	Capacitor, .033μF	C0735
C12	Capacitor, .047μF, Tant	C0700
C13	Capacitor, 159pF, 1%	C1146
C14	Capacitor, 159pF, 1%	C1146
C15	Capacitor, 1μF, 25V	C0879
C16	Capacitor, .05μF, 12V	C0672
C17	Capacitor, .01μF, 100V	C0556
C18	Capacitor, .05μF, 12V	C0672
C19	Capacitor, 82pF	C0535
C20	Capacitor, 1μF, 25V	C0879
C21	Capacitor, .05μF, 12V	C0672
C22	Capacitor, .01μF, 100V	C0556
C23	Capacitor, .001μF, 1KV	C0235
C24	Capacitor, .001μF, 1KV	C0235
C25	Capacitor, .05μF, 12V	C0672
C26	Capacitor, .05μF, 12V	C0672
C27	Capacitor, .01μF, 100V	C0556
C28	Capacitor, .05μF, 12V	C0672
C29	Capacitor, .05μF, 12V	C0672
C30	Capacitor, .05μF, 12V	C0672
C31	Capacitor, 150pF	C0537
C32	Capacitor, 150pF	C0537
C33	Capacitor, .05μF, 12V	C0672
C34	Capacitor, .1μF	C0661
C35	Capacitor, 318pF, 1%	C1145

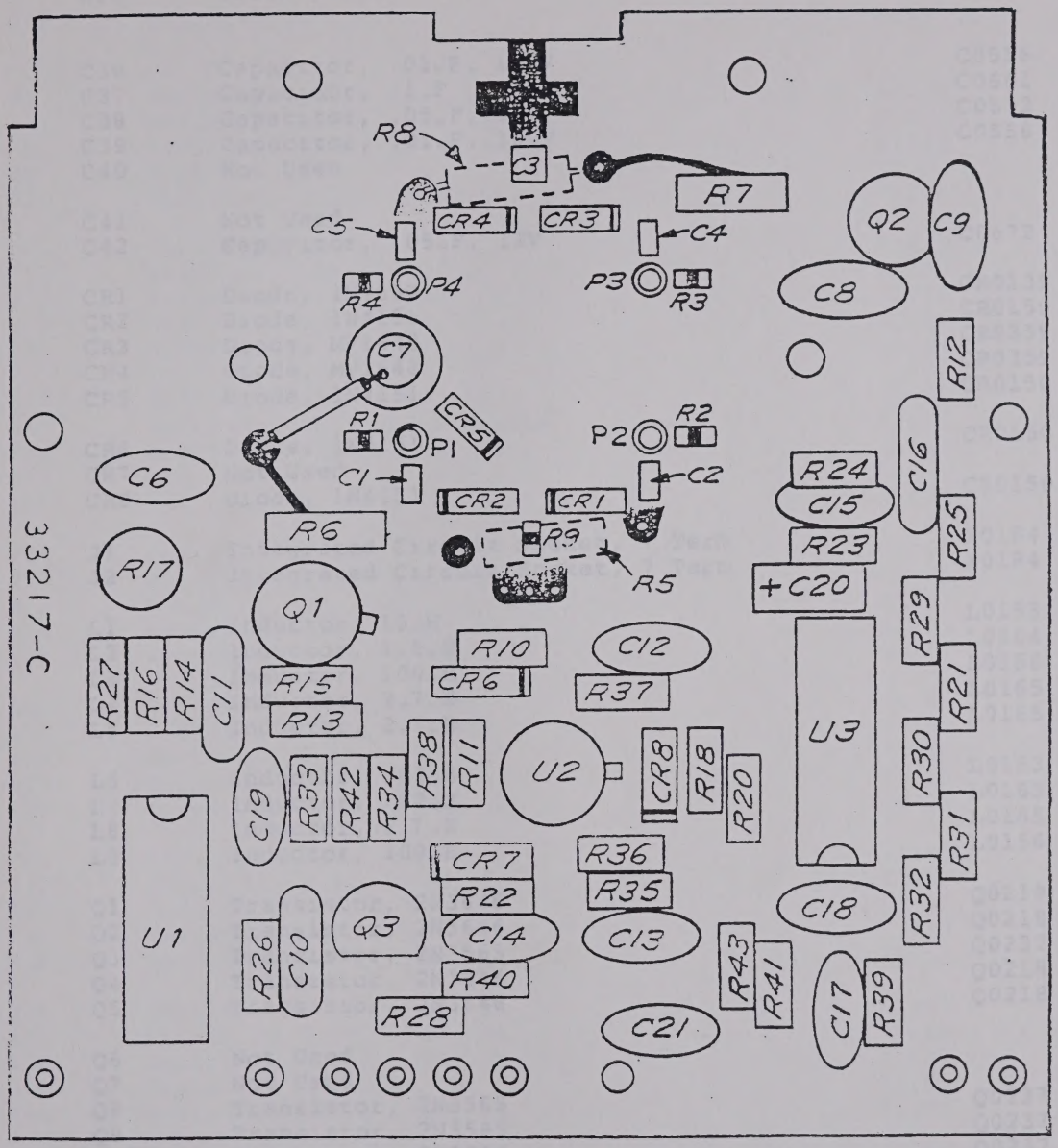
REF.	DESCRIPTION	PART NO.
	AS ACTO P.C. Assembly	C39039
	AS ACTO Schematic	C39027
C1	Capacitor, .15µF, 100V	C0327
C2	Capacitor, .005µF, 150V	C0325
C3	Capacitor, 33pF	C0531
C4	Capacitor, 150pF	C0537
C5	Capacitor, .01µF, 100V	C0556
C6	Capacitor, .05µF, 12V	C0572
C7	Capacitor, 150pF	C0537
C8	Capacitor, .01µF, 100V	C0556
C9	Capacitor, 1µF, 25V	C0875
C10	Capacitor, 1µF, 25V	C0879
C11	Capacitor, .033µF	C0735
C12	Capacitor, .047µF, Tant	C0700
C13	Capacitor, 1500pF, 1%	C1146
C14	Capacitor, 1500pF, 1%	C1146
C15	Capacitor, 1µF, 15V	C0879
C16	Capacitor, .05µF, 12V	C0572
C17	Capacitor, .01µF, 100V	C0556
C18	Capacitor, .05µF, 12V	C0572
C19	Capacitor, 820pF	C0535
C20	Capacitor, 1µF, 25V	C0879
C21	Capacitor, .05µF, 12V	C0572
C22	Capacitor, .01µF, 100V	C0556
C23	Capacitor, .001µF, 1KV	C0535
C24	Capacitor, .001µF, 1KV	C0535
C25	Capacitor, .05µF, 12V	C0572
C26	Capacitor, .05µF, 12V	C0572
C27	Capacitor, .01µF, 100V	C0556
C28	Capacitor, .05µF, 12V	C0572
C29	Capacitor, .05µF, 12V	C0572
C30	Capacitor, .05µF, 12V	C0572
C31	Capacitor, 150pF	C0537
C32	Capacitor, 150pF	C0537
C33	Capacitor, .05µF, 12V	C0572
C34	Capacitor, 1µF	C0661
C35	Capacitor, 3180pF, 1%	C1145

REF.	DESCRIPTION	SD PART NO.
R1	Not Used	
R2	Resistor, 3.3K, 1/8W, 5%	R1456
R3	Resistor, 27K, 1/8W, 5%	R2432
R4	Resistor, 82Ω, 1/8W, 5%	R1745
R5	Resistor, 820Ω, 1/8W, 5%	R2462
R6	Resistor, 27K, 1/8W, 5%	R2432
R7	Resistor, 1K, 1/8W, 5%	R1453
R8	Resistor, 1K, 1/8W, 5%	R1453
R9	Resistor, 220K, 1/8W, 5%	R2567
R10	Resistor, 100K, 1/8W, 5%	R2465
R11	Resistor, 10K, 1/8W, 5%	R1437
R12	Resistor, 2.2K, 1/8W, 5%	R1476
R13	Resistor, 47K, 1/8W, 5%	R1433
R14	Resistor, 10K, 1/8W, 5%	R1437
R15	Resistor, 22K, 1/8W, 5%	R1742
R16	Resistor, 100Ω, 1/8W, 5%	R1441
R17	Resistor, 4.7K, 1/8W, 5%	R1733
R18	Resistor, 47K, 1/8W, 5%	R1433
R19	Resistor, 2.2K, 1/8W, 5%	R1476
R20	Resistor, 2.2K, 1.8W, 5%	R1476
R21	Resistor, 470Ω, 1/8W, 5%	R1451
R22	Resistor, 470Ω, 1/8W, 5%	R1451
R23	Resistor, 100Ω, 1/8W, 5%	R1441
R24	Resistor, VAR., 5K, 2W, 30%	R2187
R25	Not Used	
R26	Resistor, 10K, 1/8W, 5%	R1437
R27	Resistor, 470Ω, 1/8W, 5%	R1451
R28	Resistor, 4.7K, 1/8W, 5%	R1733
R29	Resistor, 5.6K, 1/8W, 5%	R1458
R30	Resistor, 820Ω, 1/8W, 5%	R2462
R31	Resistor, 820Ω, 1/8W, 5%	R2462
R32	Resistor, 3.3K, 1/4W, 5%	R0742
R33	Resistor, 15K, 1/8W, 5%	R1438
R34	Resistor, 1MΩ, 1/8W, 5%	R2371
R35	Resistor, 1MΩ, 1/8W, 5%	R2371
R36	Resistor, 220Ω, 1/8W, 5%	R1743
R37	Not Used	
R38	Not Used	
R39	Resistor, 6.8K, 1/8W, 5%	R1459
R40	Not Used	



A5, ACTO SCHEMATIC, C39087R2





A6, MIXER P.C. ASSEMBLY, C33218C

Ass'y, Mixer P.C. Assembly, 633218C

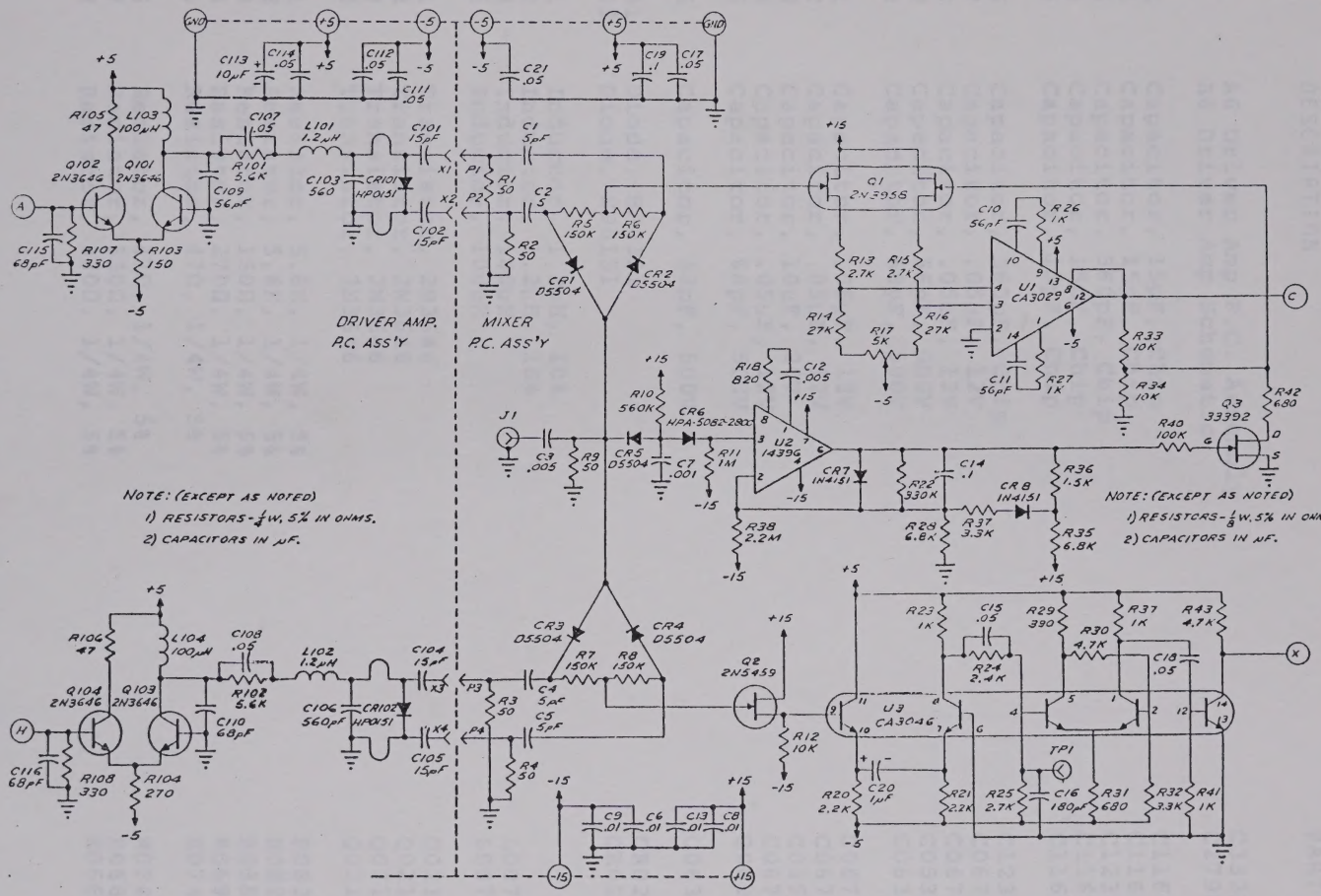
REF	DESCRIPTION	SD PART NO
C36	Capacitor, .01μF, 100V	C0556
C37	Capacitor, .1μF	C0661
C38	Capacitor, .05μF, 12V	C0672
C39	Capacitor, .01μF, 100V	C0556
C40	Not Used	
C41	Not Used	
C42	Capacitor, .05μF, 12V	C0672
CR1	Diode, 1N965B	CR0139
CR2	Diode, 1N4151	CR0150
CR3	Diode, MV1648	CR0359
CR4	Diode, MV1648	CR0359
CR5	Diode, 1N4151	CR0150
CR6	Diode, 1N4151	CR0150
CR7	Not Used	
CR8	Diode, 1N4151	CR0150
J1	Integrated Circuit Socket, 7 Term	X0184
J2	Integrated Circuit Socket, 7 Term	X0184
L1	Inductor, 10μH	L0153
L2	Inductor, 1.5μH	L0164
L3	Inductor, 100μH	L0156
L4	Inductor, 2.7μH	L0165
L5	Inductor, 2.7μH	L0165
L6	Inductor, .82μH	L0163
L7	Inductor, .82μH	L0163
L8	Inductor, 2.7μH	L0165
L9	Inductor, 100μH	L0156
Q1	Transistor, 2N3646	Q0218
Q2	Transistor, 2N3646	Q0218
Q3	Transistor, 2N3565	Q0237
Q4	Transistor, 2N3646	Q0218
Q5	Transistor, 2N3646	Q0218
Q6	Not Used	
Q7	Not Used	
Q8	Transistor, 2N3565	Q0237
Q9	Transistor, 2N3565	Q0237
Q10	Transistor, 2N3565	Q0237
Q11	Transistor, 2N4342	Q0243

REF	DESCRIPTION	PART NO
C56	Capacitor, .01µF, 100V	C0556
C57	Capacitor, 1.5	C0661
C58	Capacitor, .05µF, 12V	C0672
C59	Capacitor, .01µF, 100V	C0558
C60	Not Used	
C61	Not Used	
C62	Capacitor, .05µF, 12V	C0672
CR1	Diode, IN958B	CR0139
CR2	Diode, IN4151	CR0150
CR3	Diode, MV1648	CR0339
CR4	Diode, MV1848	CR0357
CR5	Diode, IN4151	CR0150
CR6	Diode, IN4151	CR0150
CR7	Not Used	
CR8	Diode, IN4151	CR0150
J1	Integrated Circuit Socket, 7 Term	X0184
J2	Integrated Circuit Socket, 7 Term	X0184
L1	Inductor, 10µH	L0157
L2	Inductor, 1.5µH	L0164
L3	Inductor, 100µH	L0156
L4	Inductor, 2.7µH	L0165
L5	Inductor, 2.7µH	L0165
L6	Inductor, 82µH	L0163
L7	Inductor, 82µH	L0163
L8	Inductor, 2.7µH	L0165
L9	Inductor, 100µH	L0156
Q1	Transistor, 2N3646	Q0218
Q2	Transistor, 2N3646	Q0218
Q3	Transistor, 2N3565	Q0237
Q4	Transistor, 2N3646	Q0218
Q5	Transistor, 2N3646	Q0218
Q6	Not Used	
Q7	Not Used	
Q8	Transistor, 2N3565	Q0237
Q9	Transistor, 2N3565	Q0237
Q10	Transistor, 2N3565	Q0237
Q11	Transistor, 2N4342	Q0243

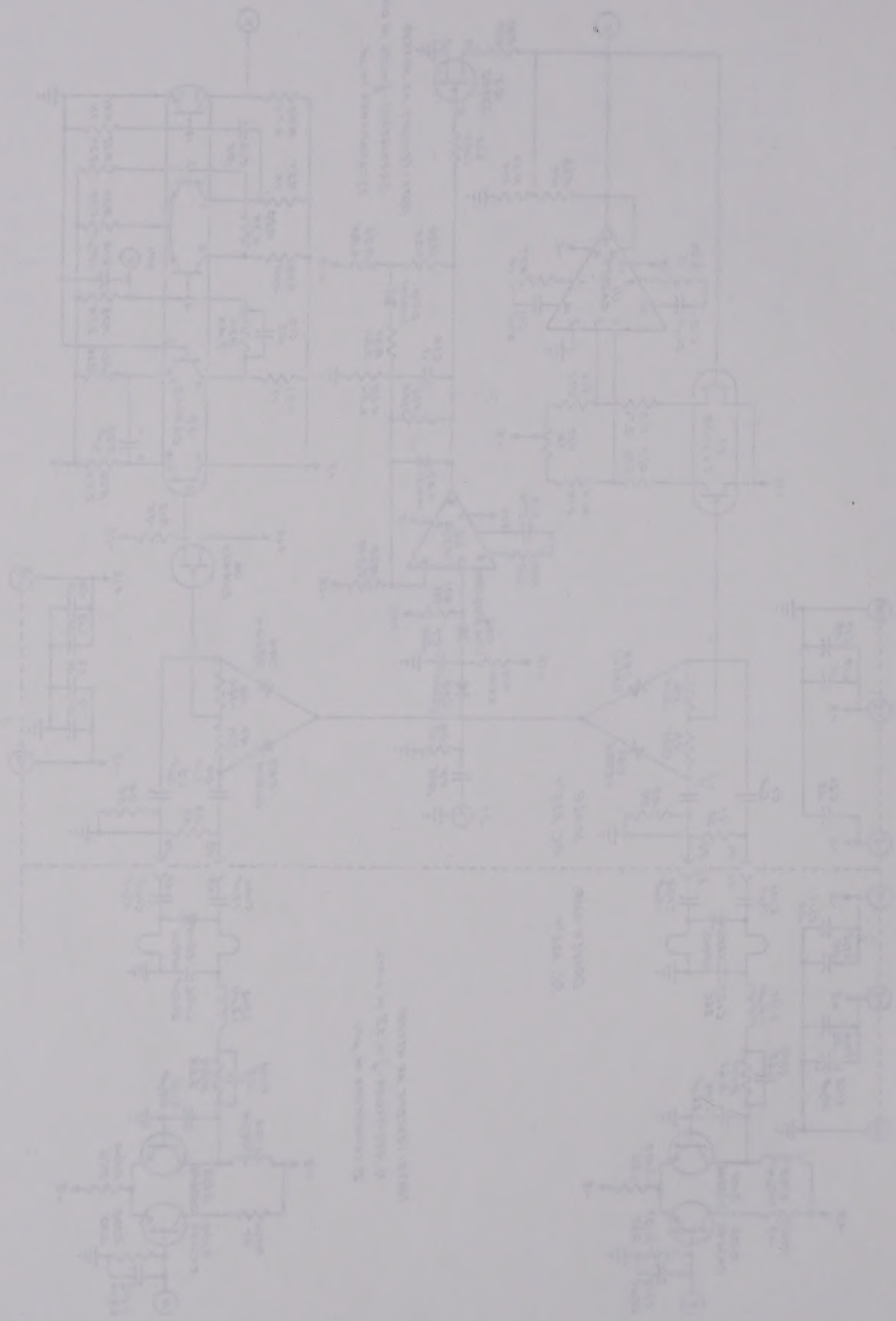
REF.	DESCRIPTION	SD PART NO.
R6	Resistor, 150K, 1/4, 1%, MF	R2421
R7	Resistor, 150K, 1/4, 1%, MF	R2421
R8	Resistor, 150K, 1/4, 1%, MF	R2421
R9	Resistor, 50 , Chip	R2494
R10	Resistor, 560K, 1/8W, 5%	R2536
R11	Resistor, 1M, 1/8W, 5%	R1435
R12	Resistor, 10K, 1/8W, 5%	R1437
R13	Resistor, 2.7K, 1/8W, 5%	R1749
R14	Resistor, 27K, 1/8W, 5%	R2432
R15	Resistor, 2.7K, 1/8W, 5%	R1749
R16	Resistor, 27K, 1/8W, 5%	R2432
R17	Resistor, 5K, Potentiometer	R2187
R18	Resistor, 820Ω, 1/8W, 5%	R2462
R19	Not Used	
R20	Resistor, 2.2K, 1/8W, 5%	R1476
R21	Resistor, 2.2K, 1/8W, 5%	R1476
R22	Resistor, 330K, 1/8W, 5%	R2535
R23	Resistor, 1K, 1/8W, 5%	R1453
R24	Resistor, 2.4K, 1/8W, 5%	R2358
R25	Resistor, 2.7K, 1/8W, 5%	R1749
R26	Resistor, 1K, 1/8W, 5%	R1453
R27	Resistor, 1K, 1/8W, 5%	R1453
R28	Resistor, 6.8K, 1/8W, 5%	R1459
R29	Resistor, 390Ω, 1/8W, 5%	R1450
R30	Resistor, 4.7K, 1/8W, 5%	R1733
R31	Resistor, 680Ω, 1/8W, 5%	R2461
R32	Resistor, 3.3K, 1/8W, 5%	R1456
R33	Resistor, 10K, 1/8W, 5%	R1437
R34	Resistor, 10K, 1/8W, 5%	R1437
R35	Resistor, 6.8K, 1/8W, 5%	R1459
R36	Resistor, 1.5K, 1/8W, 5%	R2463
R37	Resistor, 3.3K, 1/8W, 5%	R1456
R38	Resistor, 2.2M, 1/8W, 5%	R2635
R39	Resistor, 1K, 1/8W, 5%	R1453
R40	Resistor, 100K, 1/8W, 5%	R2465
R41	Resistor, 1K, 1/8W, 5%	R1453
R42	Resistor, 680Ω, 1/8W, 5%	R2461
R43	Resistor, 4.7K, 1/8W, 5%	R1733
U1	Integrated Circuit, CA3029	25757
U2	Integrated Circuit, MC1439G	25729
U3	Integrated Circuit, CA3046	25725

REF.	DESCRIPTION	PART NO.
R6	Resistor, 150K, 1/4, 1%, MF	R2421
R7	Resistor, 150K, 1/4, 1%, MF	R2421
R8	Resistor, 150K, 1/4, 1%, MF	R2421
R9	Resistor, 5Ω , CMF	R2494
R10	Resistor, 560K, 1/8W, 5%	R2539
R11	Resistor, 1M, 1/8W, 5%	R1425
R12	Resistor, 10K, 1/8W, 5%	R1427
R13	Resistor, 2.7K, 1/8W, 5%	R1749
R14	Resistor, 27K, 1/8W, 5%	R2432
R15	Resistor, 2.7K, 1/8W, 5%	R1749
R16	Resistor, 22K, 1/8W, 5%	R2432
R17	Resistor, 5K, Potentiometer	R2427
R18	Resistor, 820Ω, 1/8W, 5%	R2402
R19	Not Used	
R20	Resistor, 2.2K, 1/8W, 5%	R1476
R21	Resistor, 2.2K, 1/8W, 5%	R1476
R22	Resistor, 330K, 1/8W, 5%	R2535
R23	Resistor, 1K, 1/8W, 5%	R1423
R24	Resistor, 3.6K, 1/8W, 5%	R2538
R25	Resistor, 3.3K, 1/8W, 5%	R1749
R26	Resistor, 1K, 1/8W, 5%	R1423
R27	Resistor, 1K, 1/8W, 5%	R1423
R28	Resistor, 6.8K, 1/8W, 5%	R1459
R29	Resistor, 360Ω, 1/8W, 5%	R1460
R30	Resistor, 4.7K, 1/8W, 5%	R1751
R31	Resistor, 680Ω, 1/8W, 5%	R2461
R32	Resistor, 3.3K, 1/8W, 5%	R1456
R33	Resistor, 10K, 1/8W, 5%	R1427
R34	Resistor, 10K, 1/8W, 5%	R1427
R35	Resistor, 6.8K, 1/8W, 5%	R1459
R36	Resistor, 3.3K, 1/8W, 5%	R2463
R37	Resistor, 3.3K, 1/8W, 5%	R1456
R38	Resistor, 2.2M, 1/8W, 5%	R2535
R39	Resistor, 1K, 1/8W, 5%	R1423
R40	Resistor, 100K, 1/8W, 5%	R2465
R41	Resistor, 1M, 1/8W, 5%	R1425
R42	Resistor, 680Ω, 1/8W, 5%	R2461
R43	Resistor, 4.7K, 1/8W, 5%	R1751
U1	Integrated Circuit, CA3029	257527
U2	Integrated Circuit, MC1439G	257529
U3	Integrated Circuit, CA3046	257525

REF	DESCRIPTION	SD PART NO.
R41	Resistor, 6.8K, 1/8W, 5%	R1459
R42	Resistor, 220Ω, 1/8W, 5%	R1743
R43	Resistor, 39Ω, 1/8W, 5%	R1829
R44	Resistor, 560Ω, 1/8W, 5%	R1452
R45	Resistor, 220Ω, 1/8W, 5%	R1743
R46	Resistor, 220Ω, 1/8W, 5%	R1743
R47	Resistor, 39Ω, 1/8W, 5%	R1829
R48	Resistor, 560Ω, 1/8W, 5%	R1452
R49	Resistor, 120Ω, 1/8W, 5%	R2459
R50	Resistor, 120Ω, 1/8W, 5%	R2459
R51	Resistor, 220Ω, 1/8W, 5%	R1743
R52	Resistor, 220Ω, 1/8W, 5%	R1743
R53	Resistor, 330Ω, 1/8W, 5%	R1444
R54	Resistor, 2.2K, 1/8W, 5%	R1476
R55	Resistor, 12K, 1/8W, 5%	R2464
R56	Resistor, 499K, 1/8W, 1%	R2372
U1	Integrated Circuit, MC1439G	25729
U2	Integrated Circuit, CA3026	25724
U3	Integrated Circuit, CA3028A	25702


DRIVER AMP. P.C. ASS'Y
MIXER P.C. ASS'Y
NOTE: (EXCEPT AS NOTED)
1) RESISTORS - 1/4 W, 5% IN OHMS.
2) CAPACITORS IN MF.
NOTE: (EXCEPT AS NOTED)
1) RESISTORS - 1/8 W, 5% IN OHMS.
2) CAPACITORS IN MF.

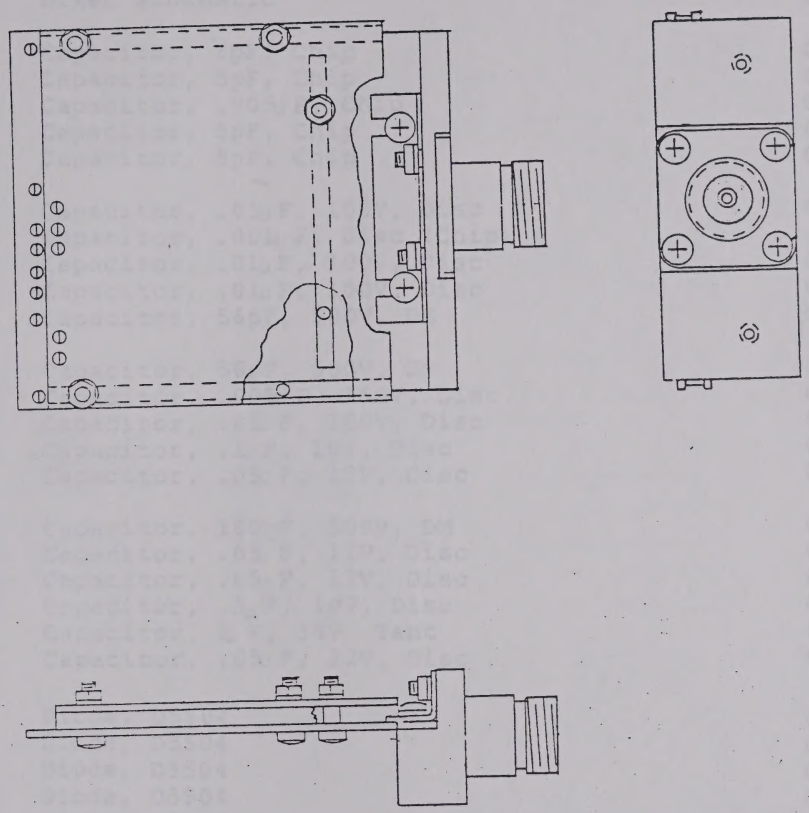
A6, MIXER & DRIVER AMP SCHEMATIC, C27988C



A6 DRIVER AMP PARTS LIST

REF.	DESCRIPTION	SD PART NO.
	A6 Driver Amp P.C. Assembly	C33221C
	A6 Driver Amp Schematic	C27988C
C101	Capacitor, 15pF, Chip	C1163
C102	Capacitor, 15pF, Chip	C1163
C103	Capacitor, 560pF, Chip	C1235
C104	Capacitor, 15pF, Chip	C1163
C105	Capacitor, 15pF, Chip	C1163
C106	Capacitor, 560pF, Chip	C1235
C107	Capacitor, .05µF, 12V	C0672
C108	Capacitor, .05µF, 12V	C0672
C109	Capacitor, 56pF, 500V	C0534
C110	Capacitor, 68pF, 500V	C0635
C111	Capacitor, .05µF, 12V	C0672
C112	Capacitor, .05µF, 12V	C0672
C113	Capacitor, 10µF, 20V	C0353
C114	Capacitor, .05µF, 12V	C0672
C115	Capacitor, 68pF, 500V	C0635
C116	Capacitor, 68pF, 500V	C0635
CR101	Diode, HP0151	CR0269
CR102	Diode, HP0151	CR0269
L101	Inductor, 1.2µH, 10%	
L102	Inductor, 1.2µH, 10%	
L103	Inductor, 100µH	L0073
L104	Inductor, 100µH	L0073
Q101	Transistor, 2N3646	Q0218
Q102	Transistor, 2N3646	Q0218
Q103	Transistor, 2N3646	Q0218
Q104	Transistor, 2N3646	Q0218
R101	Resistor, 5.6K, 1/4W, 5%	R0821
R102	Resistor, 5.6K, 1/4W, 5%	R0821
R103	Resistor, 150Ω, 1/4W, 5%	R0983
R104	Resistor, 270Ω, 1/4W, 5%	R0694
R105	Resistor, 47Ω, 1/4W, 5%	R0743
R106	Resistor, 47Ω, 1/4W, 5%	R0743
R107	Resistor, 330Ω, 1/4W, 5%	R0662
R108	Resistor, 330Ω, 1/4W, 5%	R0662

REF.	DESCRIPTION	PART NO.
	A6 Driver Amp P.C. Assembly	C1321IC
	A6 Driver Amp Schematic	C1798AC
C101	Capacitor, 15pF, Chip	C1163
C102	Capacitor, 15pF, Chip	C1163
C103	Capacitor, 560pF, Chip	C1235
C104	Capacitor, 15pF, Chip	C1163
C105	Capacitor, 15pF, Chip	C1163
C106	Capacitor, 560pF, Chip	C1235
C107	Capacitor, .05uF, 12V	C0672
C108	Capacitor, .05uF, 12V	C0672
C109	Capacitor, 56pF, 500V	C0634
C110	Capacitor, 68pF, 500V	C0635
C111	Capacitor, .05uF, 12V	C0672
C112	Capacitor, .05uF, 12V	C0672
C113	Capacitor, 10uF, 20V	C0353
C114	Capacitor, .05uF, 12V	C0672
C115	Capacitor, 68pF, 500V	C0635
C116	Capacitor, 68pF, 500V	C0635
CR101	Diode, MP0151	CR0269
CR102	Diode, MP0151	CR0269
L101	Inductor, 1.2uH, 10%	
L102	Inductor, 1.2uH, 10%	
L103	Inductor, 100uH	L0073
L104	Inductor, 100uH	L0073
Q101	Transistor, 2N3646	Q0218
Q102	Transistor, 2N3646	Q0218
Q103	Transistor, 2N3646	Q0218
Q104	Transistor, 2N3646	Q0218
R101	Resistor, 5.6K, 1/4W, 5%	R0821
R102	Resistor, 5.6K, 1/4W, 5%	R0821
R103	Resistor, 150Ω, 1/4W, 5%	R0583
R104	Resistor, 270Ω, 1/4W, 5%	R0584
R105	Resistor, 47Ω, 1/4W, 5%	R0743
R106	Resistor, 47Ω, 1/4W, 5%	R0743
R107	Resistor, 330Ω, 1/4W, 5%	R0662
R108	Resistor, 330Ω, 1/4W, 5%	R0662



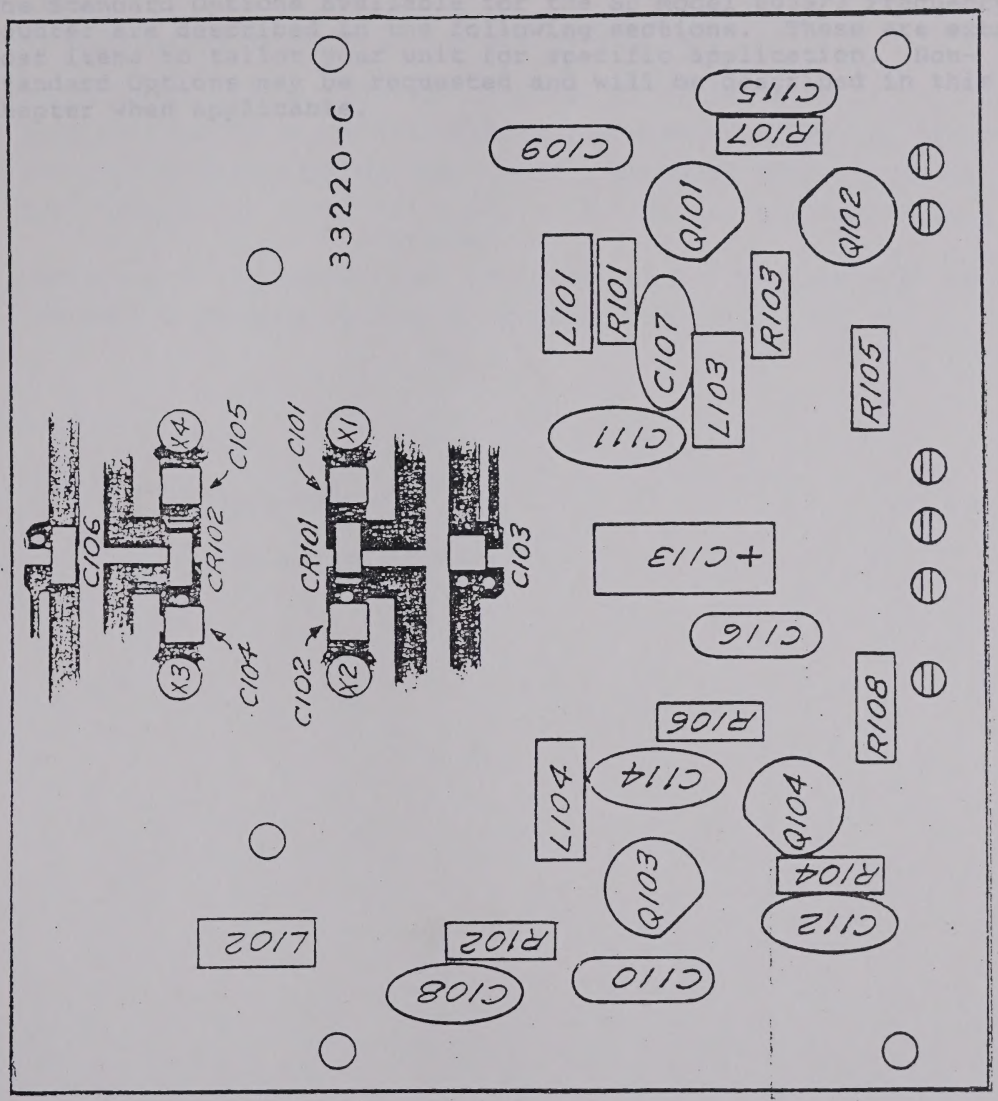
A6, MIXER FINAL ASSEMBLY, C33351B

A6 MIXER PARTS LIST

REF.	DESCRIPTION	SD PART NO.
	Mixer P.C. Assembly	C33218C
	Mixer Schematic	C27988C
C1	Capacitor, 5pF, Chip	C1187
C2	Capacitor, 5pF, Chip	C1187
C3	Capacitor, .005μF, Chip	C1245
C4	Capacitor, 5pF, Chip	C1187
C5	Capacitor, 5pF, Chip	C1187
C6	Capacitor, .01μF, 100V, Disc	C0556
C7	Capacitor, .001μF, Disc (Chip)	03287080
C8	Capacitor, .01μF, 100V, Disc	C0556
C9	Capacitor, .01μF, 100V, Disc	C0556
C10	Capacitor, 56pF, 500V, DM	C0882
C11	Capacitor, 56pF, 500V, DM	C0882
C12	Capacitor, .005μF, 150V, Disc	C0325
C13	Capacitor, .01μF, 100V, Disc	C0556
C14	Capacitor, .1μF, 10V, Disc	C0661
C15	Capacitor, .05μF, 12V, Disc	C0672
C16	Capacitor, 180pF, 500V, DM	C1138
C17	Capacitor, .05μF, 12V, Disc	C0672
C18	Capacitor, .05μF, 12V, Disc	C0672
C19	Capacitor, .1μF, 10V, Disc	C0661
C20	Capacitor, 1μF, 35V, Tant	C0524
C21	Capacitor, .05μF, 12V, Disc	C0672
CR1	Diode, D5504	CR0358
CR2	Diode, D5504	CR0358
CR3	Diode, D5504	CR0358
CR4	Diode, D5504	CR0358
CR5	Diode, D5504	CR0358
CR6	Diode, HPA 5082-2800	CR0363
CR7	Diode, 1N4151	CR0150
CR8	Diode, 1N4151	CR0150
Q1	Transistor, 2N3958	26015100
Q2	Transistor, 2N5459	Q0264
Q3	Transistor, SD Spec 33392	33392
R1	Resistor, 50Ω, Chip	R2494
R2	Resistor, 50Ω, Chip	R2494
R3	Resistor, 50Ω, Chip	R2494
R4	Resistor, 50Ω, Chip	R2494
	Resistor, 150K, 1/4W, 1%, MF	R111

A6 MIXER PARTS LIST

REF.	DESCRIPTION	SD PART NO.
	Mixer P.C. Assembly	C33218C
	Mixer Schematic	C27988C
C1	Capacitor, 5pF, Chip	C1187
C2	Capacitor, 5pF, Chip	C1187
C3	Capacitor, .005µF, Chip	C1245
C4	Capacitor, 5pF, Chip	C1187
C5	Capacitor, 5pF, Chip	C1187
C6	Capacitor, .01µF, 100V, Disc	C0556
C7	Capacitor, .001µF, Disc (Chip)	03287080
C8	Capacitor, .01µF, 100V, Disc	C0556
C9	Capacitor, .01µF, 100V, Disc	C0556
C10	Capacitor, 56pF, 500V, DM	C0882
C11	Capacitor, 56pF, 500V, DM	C0882
C12	Capacitor, .005µF, 150V, Disc	C0325
C13	Capacitor, .01µF, 100V, Disc	C0556
C14	Capacitor, .1µF, 10V, Disc	C0661
C15	Capacitor, .05µF, 12V, Disc	C0672
C16	Capacitor, 180pF, 500V, DM	C1128
C17	Capacitor, .05µF, 12V, Disc	C0672
C18	Capacitor, .05µF, 12V, Disc	C0672
C19	Capacitor, .1µF, 10V, Disc	C0661
C20	Capacitor, 1µF, 35V, Tant	C0524
C21	Capacitor, .05µF, 12V, Disc	C0672
CR1	Diode, D5504	CR0358
CR2	Diode, D5504	CR0358
CR3	Diode, D5504	CR0358
CR4	Diode, D5504	CR0358
CR5	Diode, D5504	CR0358
CR6	Diode, HPA 5082-2800	CR0363
CR7	Diode, 1N4151	CR0150
CR8	Diode, 1N4151	CR0150
Q1	Transistor, 2N3958	26015100
Q2	Transistor, 2N5459	Q0264
Q3	Transistor, SD Spec 33392	33392
R1	Resistor, 50Ω, Chip	R2494
R2	Resistor, 50Ω, Chip	R2494
R3	Resistor, 50Ω, Chip	R2494
R4	Resistor, 50Ω, Chip	[illegible]
	Resistor, 150K, 1/4W, 1%, MF	[illegible]



A6, DRIVER AMP P.C. ASSEMBLY, C33221C

CHAPTER 7
STANDARD OPTIONS

7.1 INTRODUCTION

The Standard Options available for the SD Model 6053/3 Frequency Counter are described in the following sections. These are extra cost items to tailor your unit for specific application. Non-standard Options may be requested and will be described in this chapter when applicable.

OPTION 10
OSCILLATOR B1

The B1 Option provides this instrument with a medium stability oscillator.

The B1 Oscillator specifications are as follows:

AGING RATE: ±7 parts in 10^9/24 hrs. // ±2 parts in 10^8/24 hours.

WARM-UP TIME TO REACH SPECIFIED AGING RATE: 30 days // 72 hours.

SHORT-TERM STABILITY AVERAGED OVER 1 SECOND: ±5 parts in 10^9 rms.

LONG-TERM AGING RATE: ±3 parts in 10^9/24 hours after 45 day dynamic.

VARIATION WITH TEMPERATURE: ±5 parts in 10^9/C° from -20° to +50°C.

10% CHANGE IN LINE VOLTAGE: <±2 parts in 10^9.

Parts List

Ref.	Description	SD Part No.
U1	Oscillator, Heated B1	Y0023

OPTION 11
OSCILLATOR (B3)

The B3 Option provides the instrument with a medium stability oscillator. The B3 Oscillator, unlike the standard 1 MHz oscillator, has an output frequency of 3 MHz. A divide-by-three circuit has been added to convert the oscillator's output frequency to the required 1 MHz reference.

The B3 Option comprises the B3 Oscillator, a separate power supply, and a divide-by-three circuit (refer to the Oscillator Power Supply). The improved specifications are listed below:

AGING RATE: ±3 parts in 10^9/24 hrs.

WARM-UP TIME TO REACH SPECIFIED AGING RATE: 72 hrs.

SHORT-TERM STABILITY AVERAGED OVER 1 SECOND: ±1 part in 10^{10} rms.

LONG-TERM AGING RATE: ±3 parts in 10^8/30 days.

VARIATION WITH TEMPERATURE (AVERAGE ±2 PARTS IN 10^{10}/°C): 4 parts in 10 over 20° change within -20°C to +55°C.

±10% CHANGE IN LINE VOLTAGE: ±5 parts in 10^{10}.

Parts List

Ref.	Description	SD Part No.
A7	Oscillator Power P.C. Assembly	B39487
C9	Capacitor, 500 µF, 50 V	C1243
T2	Transformer	19805
U1	Oscillator, B3	C33428

OPTION 12
OSCILLATOR (B)

The B Option provides the instrument with a high stability oscillator. The B oscillator, unlike the standard 1 MHz Oscillator, has an output frequency of 3 MHz. A divide-by-three circuit has been added to convert the oscillator's output frequency to the required 1 MHz reference frequency.

The B Option comprises the B Oscillator, a separate power supply, and a divide-by-three circuit (refer to the Oscillator Power Supply). The improved specifications are listed below:

AGING RATE: 1 part in 10^9/24 hrs.

WARM-UP TIME TO REACH SPECIFIED AGING RATE: 72 hrs.

SHORT-TERM STABILITY AVERAGED OVER 1 SECOND: 1 part in 10^{10} rms.

LONG-TERM AGING RATE: ±3 parts in 10^8/30 days.

VARIATION WITH TEMPERATURE (AVERAGE 2 PARTS IN 10^{10}/°C): ±4 parts in 10^9 over 20° change within -20° to +50°C.

10% CHANGE IN LINE VOLTAGE: ±5 parts in 10^{10}.

Parts List

Ref.	Description	SD Part No.
A7	Oscillator Power P.C. Assembly	B39487
C9	Capacitor, 500 µF, 50 V	C1243
T2	Transformer	19805
U1	Oscillator, B	C33427
	Bracket, MT'g., Osc.	B39044
	Wire List	A39551

CIRCUIT DESCRIPTION

A7 OSCILLATOR, POWER SUPPLY

SCHEMATIC #B39490R1

(used with OPTIONS 11, 12, 13)

This board contains two circuits: a regulated +28 V dc power supply and a divide-by-3 circuit.

The Oscillator Power Supply consists of a full wave bridge CR1, 2, 3, 4 which supplies 28 Volts dc to regulator U1 and series pass transistor Q1. The necessary regulated 28 Volts is then fed to the oscillator.

The divide-by-3 circuit takes the 3 MHz signal from the oscillator and uses Q2 as a buffer amplifier to supply a 3 MHz signal at the proper level to the input of the divide-by-3 integrated circuit, U2. U2 divides the 3 MHz signal by 3 and produces the 1 MHz signal use by the counter.

OPTION 13
OSCILLATOR (B4)

The B4 Option provides the instrument with a very high stability oscillator. Specifications for this oscillator are the following:

FREQUENCY OUTPUT: 1 MHz.

STABILITY:

Temperature -- Less than 5 parts in 10^{11}/C° from 0 to +15°C.

Aging Rate -- Less than 5 parts in 10^{10}/24 hours after warm-up. Up to 72 hrs. may be required to reach this aging rate after lengthy "off" periods of time.

Line Voltage -- Less than ±1 part in 10^{10} for a 10% voltage change.

Short Term -- Less than 5 parts in 10^{11} rms with measurement averaging time of one second under constant enviromental and line voltage conditions.

Frequency Retrace -- After up to 24 hours of shutdown, one hour is required to reach within 5 parts in 10^{9} of the frequency that existed at the time of turn off.

FREQUENCY ADJUST:

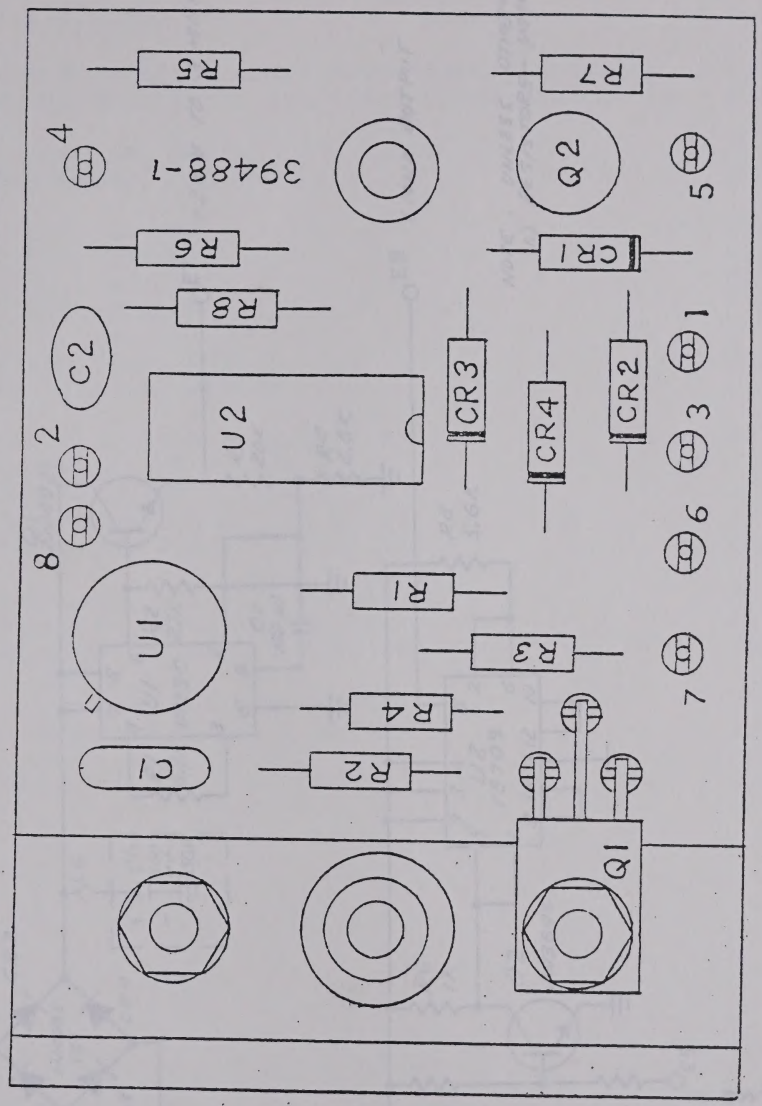
Range (Coarse) -- ±2 parts in 10^{6}.

Range (fine) -- ±7 parts in 10^{8}.

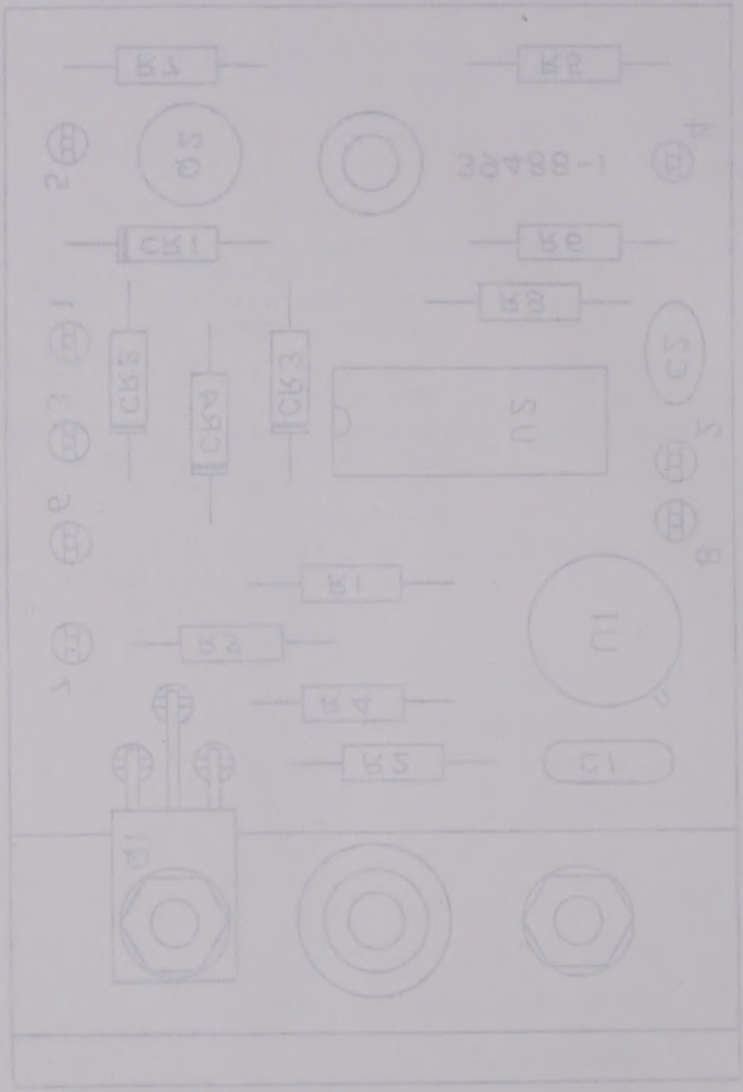
Resolution -- ±1 part in 10^{10}.

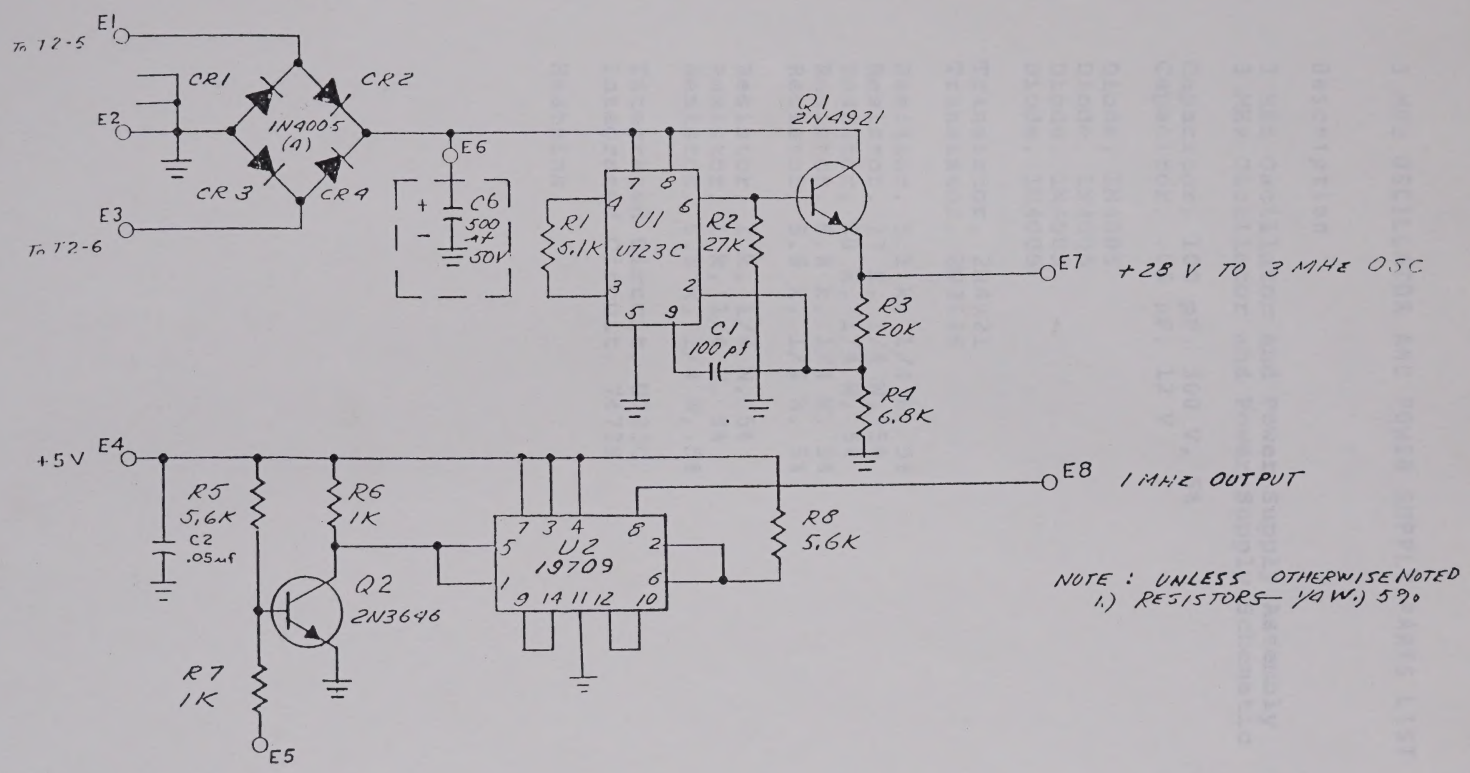
Parts List

Ref.	Description	SD Part No.
A7	Oscillator Power P.C. Assembly	B39487
C9	Capacitor, 500 µF, 50 V	C1243
T1	Transformer	19805
U1	Oscillator, B4	C33429
	Wire List	A39551

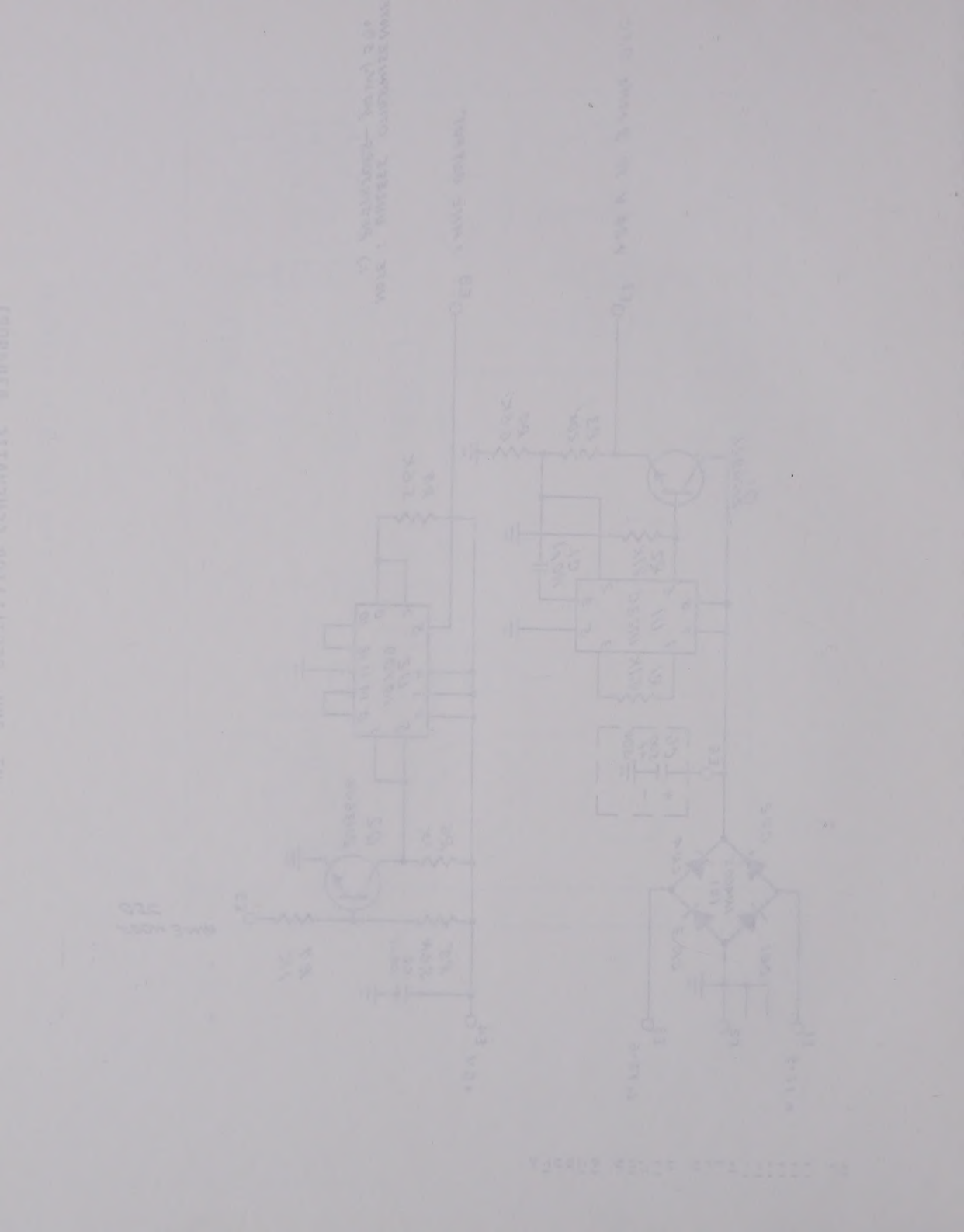


U1, 3MHz OSCILLATOR ASSEMBLY, B39487R1





U1, 3MHz OSCILLATOR SCHEMATIC, B39490R1



3 MHz OSCILLATOR AND POWER SUPPLY PARTS LIST

Ref.	Description	SD Part No.
	3 MHz Oscillator and Power Supply Assembly	B39487A
	3 MHz Oscillator and Power Supply Schematic	B39490A
C1	Capacitor, 100 pF, 500 V, 5%	C0536
C2	Capacitor, .05 µF, 12 V	C0672
CR1	Diode, 1N4005	CR0284
CR2	Diode, 1N4005	CR0284
CR3	Diode, 1N4005	CR0284
CR4	Diode, 1N4005	CR0284
Q1	Transistor, 2N4921	Q0267
Q2	Transistor, 2N3646	Q0218
R1	Resistor, 5.1 k, 1/4 W, 5%	R0693
R2	Resistor, 27 k, 1/4 W, 5%	R0824
R3	Resistor, 20 k, 1/4 W, 5%	R0964
R4	Resistor, 6.8 k, 1/4 W, 5%	R0696
R5	Resistor, 5.6 k, 1/4 W, 5%	R0821
R6	Resistor, 1 k, 1/4 W, 5%	R0765
R7	Resistor, 1 k, 1/4 W, 5%	R0765
R8	Resistor, 5.6 k, 1/4 W, 5%	R0821
U1	Integrated Circuit, U723C	25756
U2	Integrated Circuit, 7473N	19709
	Heatsink	A39486

Ref.	Description	SD Part No.
	3 MHz Oscillator and Power Supply Assembly	819687A
	3 MHz Oscillator and Power Supply Schematic	819690A
C1	Capacitor, 100 pF, 500 V, 5%	C0536
C2	Capacitor, .05 uF, 12 V	C0672
CR1	Diode, 1N4005	C0128
CR2	Diode, 1N4005	C0128
CR3	Diode, 1N4005	C0128
CR4	Diode, 1N4005	C0128
Q1	Transistor, 2N4921	Q0267
Q2	Transistor, 2N3646	Q0218
R1	Resistor, 5.1 K, 1/4 W, 5%	R0693
R2	Resistor, 27 K, 1/4 W, 5%	R0824
R3	Resistor, 20 K, 1/4 W, 5%	R0954
R4	Resistor, 6.8 K, 1/4 W, 5%	R0896
R5	Resistor, 5.6 K, 1/4 W, 5%	R0821
R6	Resistor, 1 K, 1/4 W, 5%	R0763
R7	Resistor, 1 K, 1/4 W, 5%	R0763
R8	Resistor, 5.6 K, 1/4 W, 5%	R0821
U1	Integrated Circuit, U7210	J1756
U2	Integrated Circuit, 7812K	L0709
	Heatsink	J1048A

OPTION 15
DECADE INDICATORS (E)

The E Option adds one readout digit to the standard instrument. Refer to the Standard Readout drawings.

Parts List

Ref.	Description	SD Part No.
U51	Integrated Circuit, SN7441N	19707
U52	Integrated Circuit, SN7075N	25731
U53	Integrated Circuit, SN7090N	25732
V8	Tube, Readout, NL5859S	V0131

OPTION 16

RECALL INDICATORS (EE)

The EE Option adds two readout digits to the standard unit. Refer to the standard Readout drawings.

Parts List

Ref.	Description	SD Part No.
U51	Integrated Circuit, SN7441N	19707
U52	Integrated Circuit, SN7075N	25731
U53	Integrated Circuit, SN7090N	25732
U54	Integrated Circuit, SN7441N	19707
U55	Integrated Circuit, SN7075N	25731
U56	Integrated Circuit, SB7090N	25732
V8	Tube, Readout, NL5859S	V0131
V9	Tube, Readout, NL5859S	V0131

OPTION 17
DATA OUTPUT (D3)

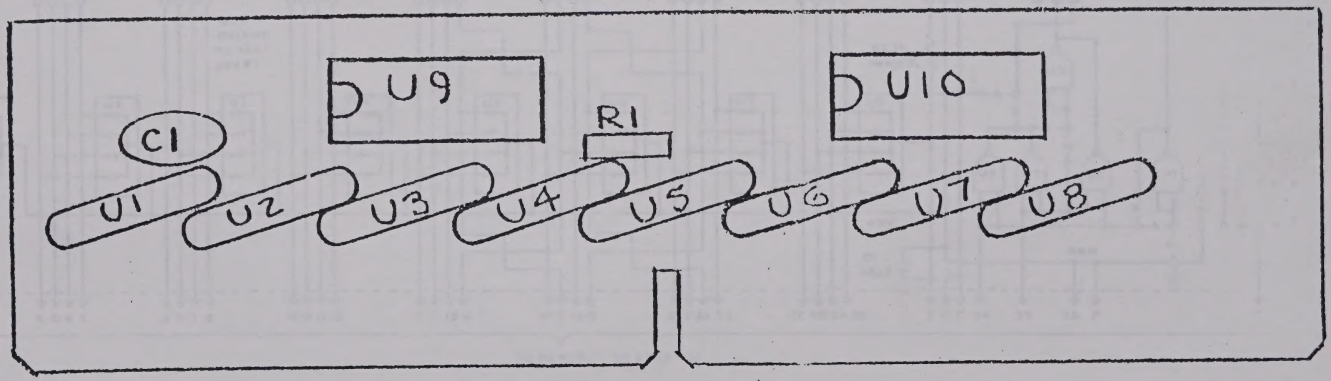
BCD pin assignments:

DIGIT DISPLAYED	BCD	PIN
10^0	1	1
	2	2
	4	26
	8	27
10^1	1	3
	2	4
	4	28
	8	29
10^2	1	5
	2	6
	4	30
	8	31
10^3	1	7
	2	8
	4	32
	8	33
10^4	1	9
	2	10
	4	34
	8	35
10^5	1	11
	2	12
	4	36
	8	37

DIGIT DISPLAYED	BCD	PIN
10^6	1	13
	2	14
	4	38
	8	39
10^7	1	15
	2	16
	4	40
	8	41
ANNUNCIATION		
Measurement Unit	1	17
	2	18
	4	42
	8	43
Decimal Point	1	19
	2	20
	4	44
	8	45
RECORDER CONTROL		
+ Reference		25
- Reference		24
Instrument Ground		50
Print Command *		48
Inhibit Transfer		47

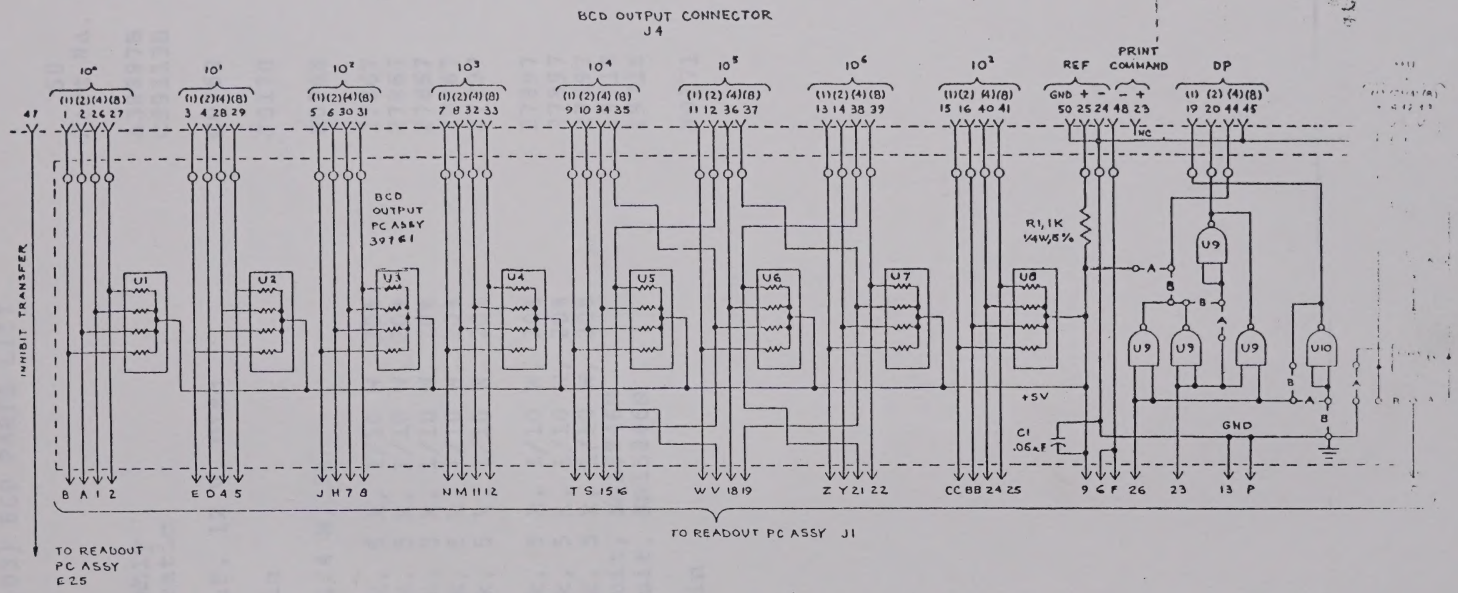
* 0 → +15 volt transition at end of count.

J4 (BCD OUT) Connector = Amphenol 57-40500
Mating Connector = Amphenol 57-30500



OPTION 17 (D3) BCD ASSEMBLY A39897B

1U
5U
3U
4U
2U
0U
7U
8U
9U
10U
1B

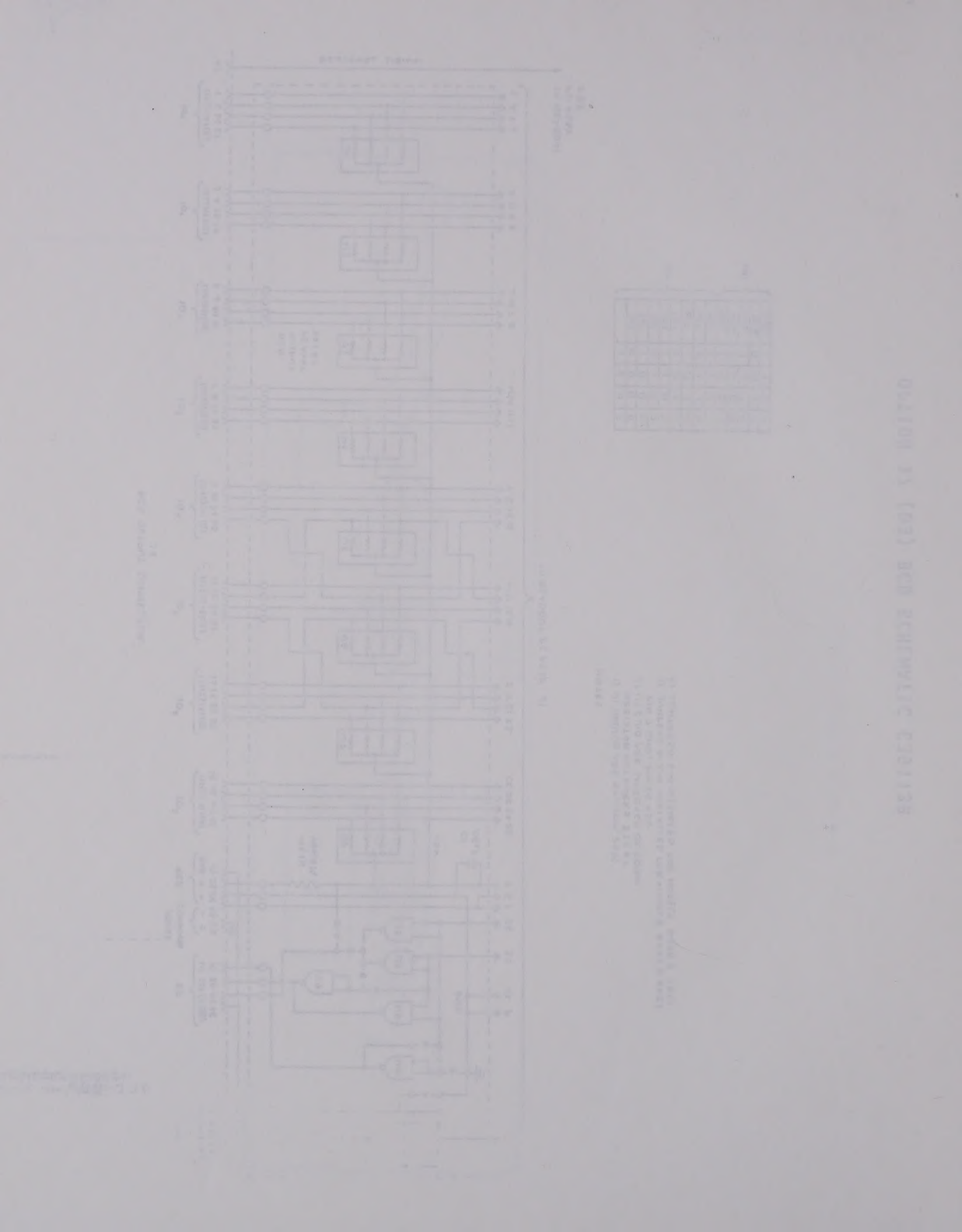


		1	2	4	8
DP	10^0	0	0	0	0
	10^1	1	0	0	0
	10^2	0	1	0	0
	10^3	1	1	0	0
	10^4	0	0	1	0
	10^5	1	0	1	0
	10^6	0	1	1	0
	10^7	1	1	1	0
MU	MHz	1	0	0	0
	KHz	0	1	0	0
	μS	1	0	1	0
	mS	0	0	1	0
	SEC	1	1	0	0

NOTES

1) U1 THRU U8 ARE 5K, 1/10W, 20% RESISTOR NETWORKS 27867
2) U9 & U10 ARE SN1584GN OR EQUIV. PIN 7 GND, PIN 14 +5V
3) JUMPERS 0-A-0 INSTALLED FOR MODELS 6052 & 6053
4) JUMPERS 0-B-0 INSTALLED FOR MODELS 6050 & 6051

OPTION 17 (D3) BCD SCHEMATIC C39113B



OPTION 17 (D3) BCD PARTS LIST

Ref.	Description	SD Part No.
	BCD Output Assembly	A39897B
	BCD Output Schematic	C39113B
C1	Capacitor, .05 µF, 12 V, Disc	C0762
J4	Connector, 50 Pin	J0170
R1	Resistor, 1 k, 1/4 W, 5%	R0765
U1	Resistor Network, 5 k, 1/10 W, 20%	27867
U2	Resistor Network, 5 k, 1/10 W, 20%	27867
U3	Resistor Network, 5 k, 1/10 W, 20%	27867
U4	Resistor Network, 5 k, 1/10 W, 20%	27867
U5	Resistor Network, 5 k, 1/10 W, 20%	27897
U6	Resistor Network, 5 k, 1/10 W, 20%	27897
U7	Resistor Network, 5 k, 1/10 W, 20%	27897
U8	Resistor Network, 5 k, 1/10 W, 20%	27897
U9	Integrated Circuit, SN15846N	19716
U10	Integrated Circuit, SN15846N	19716
P4	Connector, 50 Pin	J0171

OPTION 17 (03)

OPTION 20
REMOTE OPERATION (P)

Remote control pin assignments:

PIN NO.	CONTROLS
1	Inhibit Reset
2	Reset (closure to ground will reset instrument only when gate is closed.)
4	FUNCTION "B"
5	FUNCTION "C"
6	FUNCTION "D"
8	RESOLUTION "B"
9	RESOLUTION "C"
10	RESOLUTION "D"
12	+5 V
14	Ground

DESIRED FUNCTION	GROUND PINS	DESIRED RESOLUTION	GROUND PINS
ACTO			
TEST	6	1	8
X1	NONE	10	9
X10	4	10^2	8 & 9
X100	5	10^3	8 & 10
X1000	4 & 5	10^4	9 & 10
		10^5	8, 9, & 10

J4 (REMOTE CONTROL) = Amphenol 57-40140
Mating Connector = Amphenol 57-30140

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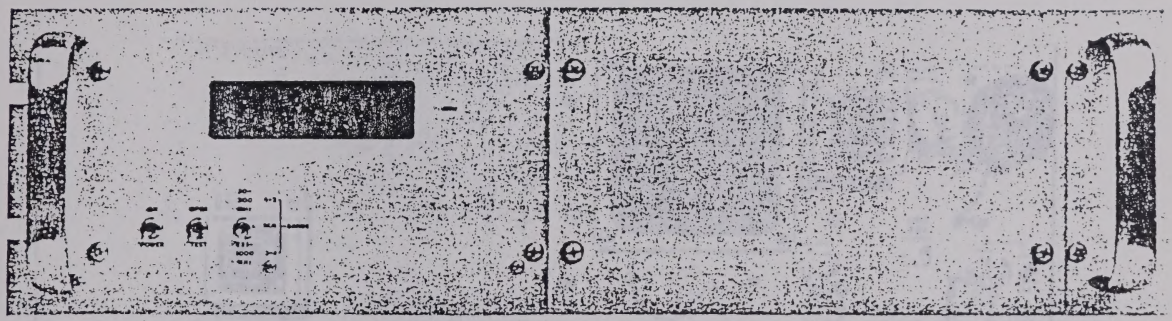
INSTRUCTION MANUAL



FRONT PANEL, MODEL 6053-304A

CONCORD INSTRUMENT
DIVISION
MODEL 6053-304A
COUNTER

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FRONT PANEL, MODEL 6053-30GA

CONCORD INSTRUMENT
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MODEL 6053-30GA

COUNTER

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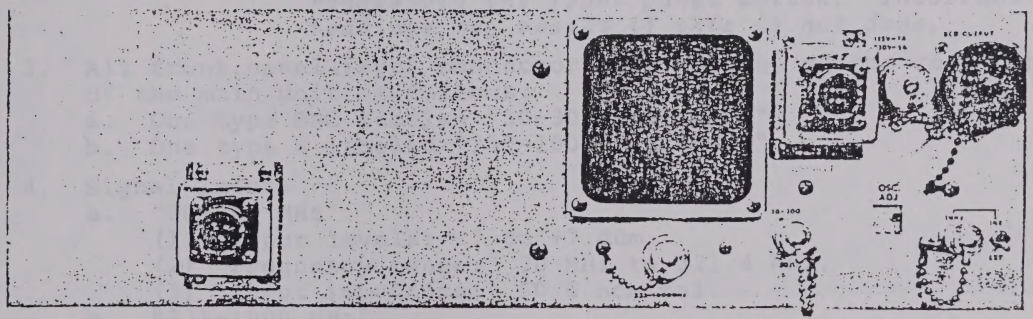

REAR PANEL, MODEL 6053-304A

ADDENDUM
MODEL 6053-304A

The Model 6053-304A Counter includes the following requirements in addition to the standard specifications for the Model 6053.

1. Six (6) digits of display.
2. Four (4) front panel controls as follows:
   a. POWER-ON, toggle switch.
   b. TEST - OPER toggle switch. The Counter measures 1 MHz internal oscillator in the TEST position, and is enabled to measure the frequency of input signals when the switch is set to OPER.
   c. BANDS 1-2, REM, BANDS 3-4 toggle switch. When set to BANDS 1-2, the counter will measure the frequency of signals in the range of 30 to 300 MHz applied to J3. When set to BANDS 3-4, the counter will measure the frequency of signals in the range of 235 to 1000 MHz applied to J1. When the REM mode is selected, either of the two frequency ranges may be selected remotely via control lines available at the BCD connector.

      CAUTION: Remove ground from control lines when selecting ranges via the front panel switch. Incorrect readings may result if this is not done.
3. All front panel input connectors are located on the rear panel of the main unit as follows:
   a. One type BNC labeled "30-300 MHz, 50 Ω".
   b. One type N labeled "235-1000 MHz, 50 Ω".
4. Signal Inputs
   a. "30-300 MHz"
      (1) Input levels: -7 to +7 dBm.
      (2) Frequency range: 30 MHz to 321.4 MHz.
      (3) Input impedance: 50 Ω nominal.
   b. "235-1000 MHz"
      (1) Input levels: -7 to +7 dBm.
      (2) Frequency range: 235 MHz to 3 GHz.
      (3) Input impedance: 50 Ω nominal.
5. BCD output connector on rear panel provides 1-2-4-8 TTL compatible BCD output for six (6) digits in addition to units of annunciation and decimal point location.
6. Counter will measure frequency to 1 kHz resolution.
7. When measuring signals in BANDS 1-2 (paragraphs 2 (c) and 4 (a) above), the counter will display a reading exactly 21.4 MHz below measured signal.
8. When measuring signals in BANDS 3-4 (paragraphs 2 (c) and 4 (b) above), the counter will display a reading exactly 60 MHz below the measured signal.
9. Counter recycle time is minimized - not to exceed 100ms.

ADDENDUM
MODEL 6053-3014A

The Model 6053-3014A Counter includes the following requirements in addition to the standard specifications for the Model 6053.

1. Six (6) digits of display.

2. Four (4) front panel controls as follows:
   a. POWER-ON, toggle switch.
   b. TEST - OPER toggle switch. The Counter measures 1 MHz internal oscillator in the TEST position, and is enabled to measure the frequency of input signals when the switch is set to OPER.
   c. BANDS 1-2, REM, BANDS 3-4 toggle switch. When set to BANDS 1-2, the counter will measure the frequency of signals in the range of 30 to 300 MHz applied to J3. When set to BANDS 3-4, the counter will measure the frequency of signals in the range of 235 to 1000 MHz applied to J1. When the REM mode is selected, either of the two frequency ranges may be selected remotely via control lines available at the BCD connector.

   CAUTION: Remove ground from control lines when selecting ranges via the front panel switch. Incorrect readings may result if this is not done.

3. All front panel input connectors are located on the rear panel of the main unit as follows:
   a. One type BNC labeled "30-300 MHz, 50 Ω".
   b. One type N labeled "235-1000 MHz, 50 Ω".

4. Signal Inputs
   a. "30-300 MHz"
      (1) Input levels: -7 to +7 dBm.
      (2) Frequency range: 30 MHz to 321.4 MHz.
      (3) Input impedance: 50 Ω nominal.
   b. "235-1000 MHz"
      (1) Input levels: -7 to +7 dBm.
      (2) Frequency range: 235 MHz to 1 GHz.
      (3) Input impedance: 50 Ω nominal.

5. BCD output connector on rear panel provides 1-2-4-8 TTL compatible BCD output for six (6) digits in addition to units of annunciation and decimal point location.

6. Counter will measure frequency to 1 KHz resolution.

7. When measuring signals in BANDS 1-2 (paragraphs 2 (c) and 4 (a) above), the counter will display a reading exactly 21.4 MHz below measured signal.

8. When measuring signals in BANDS 3-4 (paragraphs 2 (c) and 4 (b) above), the counter will display a reading exactly 60 MHz below the measured signal.

9. Counter recycle time is minimized - not to exceed 100ms.

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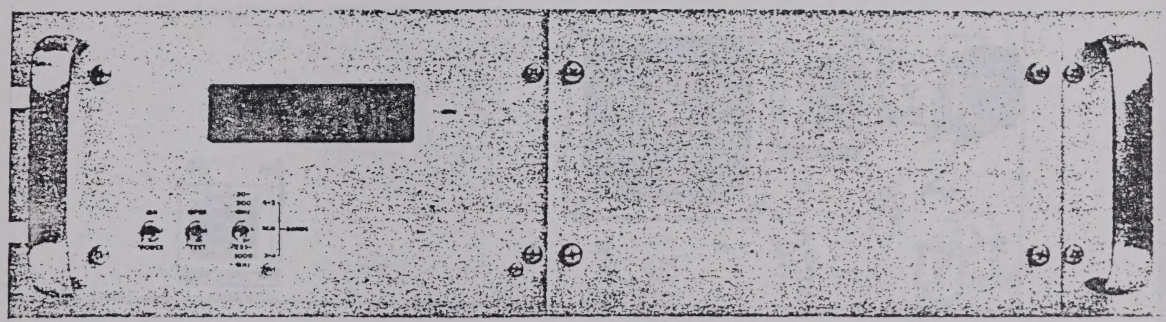

FRONT PANEL, MODEL 6053-304A

CONCORD INSTRUMENT
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MODEL 6053-304A
COUNTER

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FRONT PANEL, MODEL 8053-30dA

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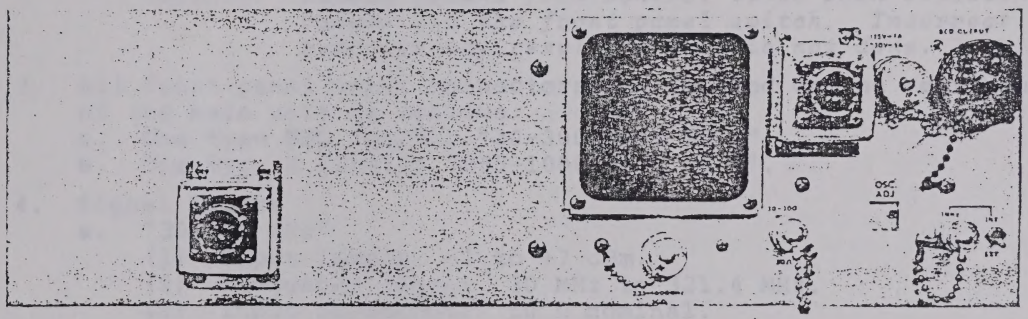


REAR PANEL, MODEL 6053-304A

ADDENDUM
MODEL 6053-304A

The Model 6053-304A Counter includes the following requirements in addition to the standard specifications for the Model 6053.

1. Six (6) digits of display.
2. Four (4) front panel controls as follows:
   a. POWER-ON, toggle switch.
   b. TEST - OPER toggle switch. The Counter measures 1 MHz internal oscillator in the TEST position, and is enabled to measure the frequency of input signals when the switch is set to OPER.
   c. BANDS 1-2, REM, BANDS 3-4 toggle switch. When set to BANDS 1-2, the counter will measure the frequency of signals in the range of 30 to 300 MHz applied to J3. When set to BANDS 3-4, the counter will measure the frequency of signals in the range of 235 to 1000 MHz applied to J1. When the REM mode is selected, either of the two frequency ranges may be selected remotely via control lines available at the BCD connector.

      CAUTION: Remove ground from control lines when selecting ranges via the front panel switch. Incorrect readings may result if this is not done.
3. All front panel input connectors are located on the rear panel of the main unit as follows:
   a. One type BNC labeled "30-300 MHz, 50 Ω".
   b. One type N labeled "235-1000 MHz, 50 Ω".
4. Signal Inputs
   a. "30-300 MHz"
      (1) Input levels: -7 to +7 dBm.
      (2) Frequency range: 30 MHz to 321.4 MHz.
      (3) Input impedance: 50 Ω nominal.
   b. "235-1000 MHz"
      (1) Input levels: -7 to +7 dBm.
      (2) Frequency range: 235 MHz to 3 GHz.
      (3) Input impedance: 50 Ω nominal.
5. BCD output connector on rear panel provides 1-2-4-8 TTL compatible BCD output for six (6) digits in addition to units of annunciation and decimal point location.
6. Counter will measure frequency to 1 kHz resolution.
7. When measuring signals in BANDS 1-2 (paragraphs 2 (c) and 4 (a) above), the counter will display a reading exactly 21.4 MHz below measured signal.
8. When measuring signals in BANDS 3-4 (paragraphs 2 (c) and 4 (b) above), the counter will display a reading exactly 60 MHz below the measured signal.
9. Counter recycle time is minimized - not to exceed 100ms.

10. Counter Inhibit Command - This input is applied to the BCD Output connector (contact closure or equivalent) or (T^2L "0", sink 5 mA). Upon inhibit input the counter will finish measurement in process and hold until inhibit is released.

11. The counter will not emit or conduct RFI of such a level that it interferes with the normal performance of the rest of the system, including the CEI Reciever Model RS-111-1B-17C when used in conjunction with CEI Auto-Scan Model MD-104.

12. Each counter is supplied with a standard 19" rack panel suitable for mounting both the counter and an accessory equipment item.

13. BCD connector pin assignment (J4 = PT02A-20-41S)

DIGIT DISPLAYED	BCD	PIN	RECORDER CONTROL	PIN	NOTES
10^0	1	A	+ Reference	g	(1)
	2	B	- Reference	S	(2)
	4	C	Instrument Ground	V	
	8	D	Print Command	q	(3)
10^1	1	E	REMOTE CONTROL		
	2	F	Bands 1-2	e	(5)
	4	G	Bands 3-4	j	(5)
	8	H	MHz = BCD 1		
10^2	1	J	NOTES		
	2	K	(1) +5 VDC		
	4	L	(2) Ground		
	8	M	(3) Signal changes from 0 V dc to +15 V dc at end of count		
10^3	1	W	(4) Contact closure to ground (or saturate NPN transistor) prevents instrument from recycling.		
	2	X			
	4	Y			
	8	Z	(5) Ground true, sink 10 mA max. Do not ground both lines simultaneously.		
10^4	1	a			
	2	b			
	4	c			
	8	d			
10^5	1	k			
	2	m			
	4	n			
	8	p			
Annunciation	1	h	Positive true logic unless noted otherwise. "1" = +5 ±0.5 V, "0" = 0.25 ±0.25 V. Compatible with TTL, DTL, & RTL logic		
Decimal Point	2	i			
	4	P			
	8	N			
Measurement Unit	1	f			
	2	R			
	4	T			
	8	N			

10. Counter Inhibit Command + This input is applied to the BCD Output connector (contact closure or equivalent) or (I^2L "0", sink 5 mA). Upon inhibit input the counter will finish measurement in process and hold until inhibit is released.

11. The counter will not emit or conduct RFI of such a level that it interferes with the normal performance of the rest of the system, including the CEI Receiver Model RS-111-IB-17C when used in conjunction with CEI Auto-Scan Model RS-104.

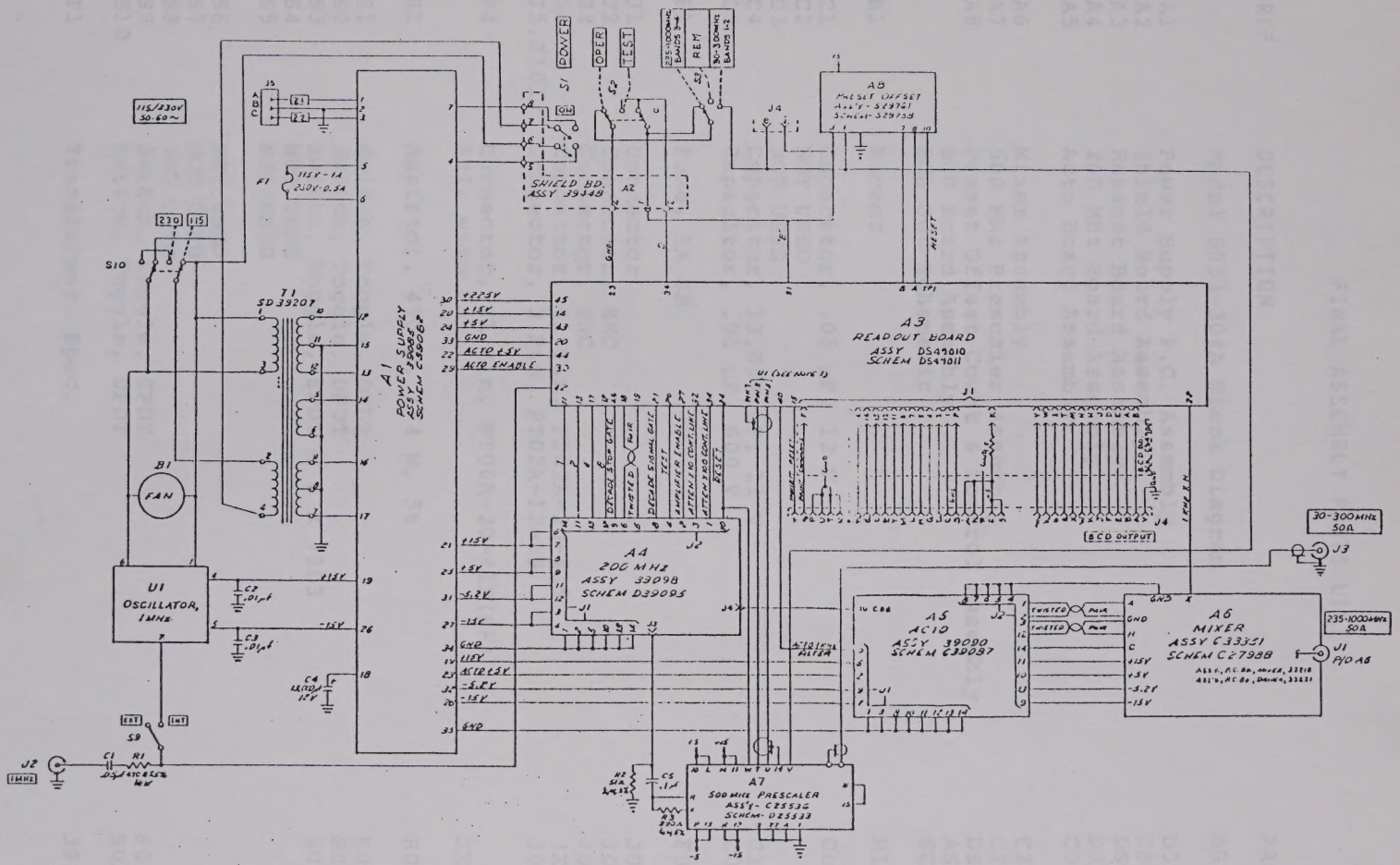
12. Each counter is supplied with a standard 19" rack panel suitable for mounting both the counter and an accessory equipment item.

13. BCD connector pin assignment (J4 = P7024A-20-41S)

DIGIT DISPLAYED	BCD	PIN	REMOTE CONTROL	PIN	NOTES
10^0	1	A	+ Reference	d	(1)
	2	B	- Reference	B	(2)
	4	C	Instrument Ground	V	
	8	D	Print Command	q	(4)
10^1	1	E	REMOTE CONTROL		
	2	F	Bands 1-2	e	(5)
	4	G	Bands 3-4	j	(5)
	8	H	MUX = BCD 1		
10^2	1	J	NOTES		
	2	K	(1) +5 VDC		
	4	L	(2) Ground		
	8	M	(3) Signal changes from 0 V dc to +15 V dc at end of count		
10^3	1	N	(4) Contact closure to ground for		
	2	X	resumes MPH translator) pre-		
	4	Y	vents instrument from recycling.		
	8	Z	(5) Ground true, sink 10 mA max. Do not ground both lines simul- taneously.		
10^4	1	a			
	2	b			
	4	c			
	8	d			
10^5	1	X			
	2	m			
	4	n			
	8	P			
Annunciation	1	R	Positive true logic unless noted		
Decimal	2	I	otherwise. "1" = +5 ±0.5 V, "0"		
Point	4	J	= 0.15 ±0.25 V. Compatible with		
	8	W	TTL, DTL, & RTL logic		
Measurement	1	T			
Unit	2	K			
	4	t			
	8	M			

14. The following drawings have been added:

Block Diagram, Model 6053-304A DS49012R2
A2 Shield Board Assembly CS49005R1
A3 Readout P.C. Assembly DS49010R1
A3 Readout Schematic (1 of 2) DS49011R1
A3 Readout Schematic (2 of 2) DS49011R1
A7 500 MHz Prescaler P.C. Assembly C25536G
A7 500 MHz Prescaler Schematic D25533F
A8 Preset Offset Count & Control P.C. Assembly DS29761R2
A8 Preset Offset Count & Control Schematic DS29758R2
BCD Output P.C. Assembly AS49006R1
BCD Output Schematic CS49007R2



BLOCK DIAGRAM, MODEL 6053-304A DS49012R2

BLOCK DIAGRAM, MODEL 6023-304A OPERATION

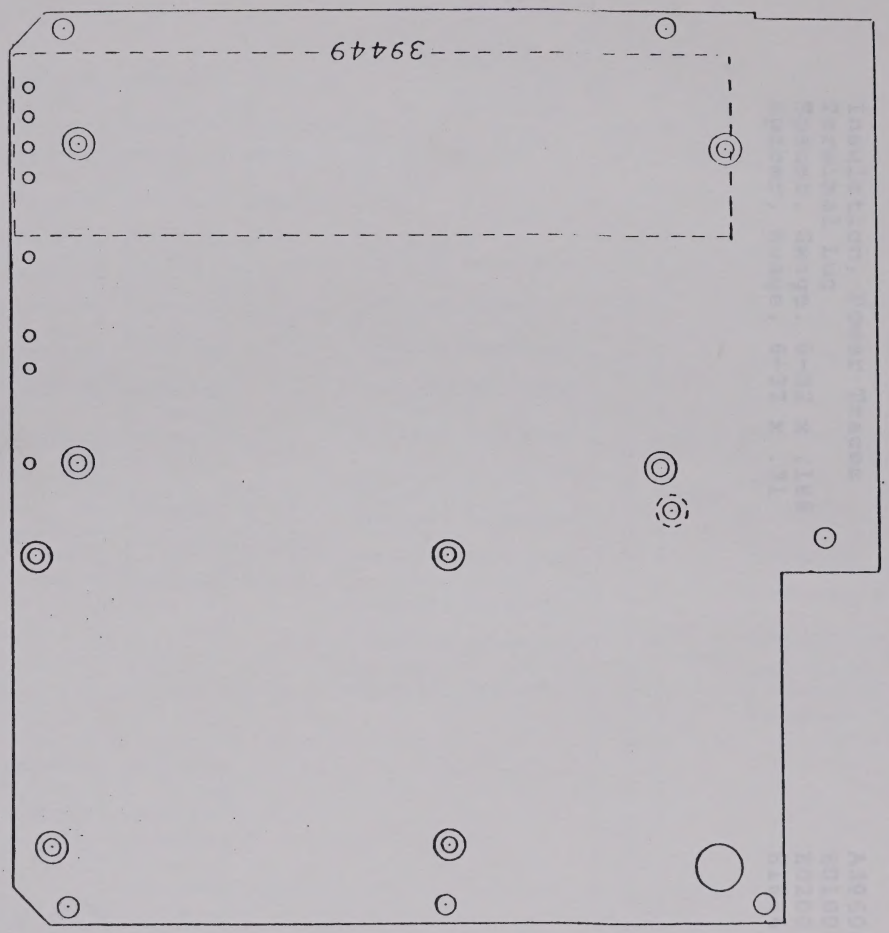
FINAL ASSEMBLY PARTS LIST

REF	DESCRIPTION	SD PART NO.
	Model 6053-304A Block Diagram	BS49012
A1	Power Supply P.C. Assembly	D39085
A2	Shield Board Assembly	CS49005
A3	Readout Board Assembly	DS49010
A4	200 MHz Board Assembly	D39098
A5	Acto Board Assembly	C39090
A6	Mixer Assembly	C33351
A7	500 MHz Prescaler Assembly	C25536
A8	Preset Offset Count & Control Assembly	DS29761
	BCD Board Assembly	AS49006
	BCD Out Schematic	SC49007
B1	Blower	H1786
C1	Capacitor, .05 µF, 12 V	C0672
C2	NOT USED	
C3	NOT USED	
C4	Capacitor, 13,000 µF, 12 V	C1122
C5	Capacitor, .01 µF, 600 V	C0169
F1	Fuse, 1A SB	F0005
J1	Connector	J0605
J2	Connector, BNC	J0260
J3	Connector, BNC	J0260
J4	Connector, 41 Pin, PT02A-20-41S	JXXXX
J5,J101	Connector, 3 Pin, PT02A-12-3P	J0445
P4	Connector, 41 Pin, PT06A-20-41P(SR) Ship with J4	JXXXX
R1	Resistor, 470 Ω, 1/4 W, 5%	R0144
S1	Switch, Toggle, DPDT	S0150
S2	Switch, Toggle, DPDT	S0150
S3	Switch, Toggle, SPDT C & K 7103	S0376
S4	NOT USED	
S5	NOT USED	
S6	NOT USED	
S7	NOT USED	
S8	NOT USED	
S9	Switch, Toggle, SPDT	S0149
S10	Switch, Toggle, DPDT	S0150
T1	Transformer, Spec.	39207

FINAL ASSEMBLY PARTS LIST (Cont'd)

REF	DESCRIPTION	SD PART NO.
U1	Oscillator	33151
XF1	Fuseholder	X0157
Z1	Filter, USCC 2430-004	
Z2	Filter, USCC 2430-004	
	Connector, 3 Pin, PT Series (ship with J101)	J0449
	Capacitor, Connector (BNC)	H1598
	Capacitor, Clamp	H0652
	Handle	H0947
	Filter	8100559
	Capacitor, Connector N Series, Amphenol 82-106	HXXXX
	Connector, 44 Pin, P.C.	J0246
	Chassis	S49015
	Front Panel	S49016
	Cover, Top	S49017
	Fan Screen	S29838
	Window Screen	S29839
	Polarized Window	S29840
	Cover, Bottom	S49018
	Line Cord Assembly	S29920
	Bottom Cover Screen	S29921
	Filter Shield	S29924

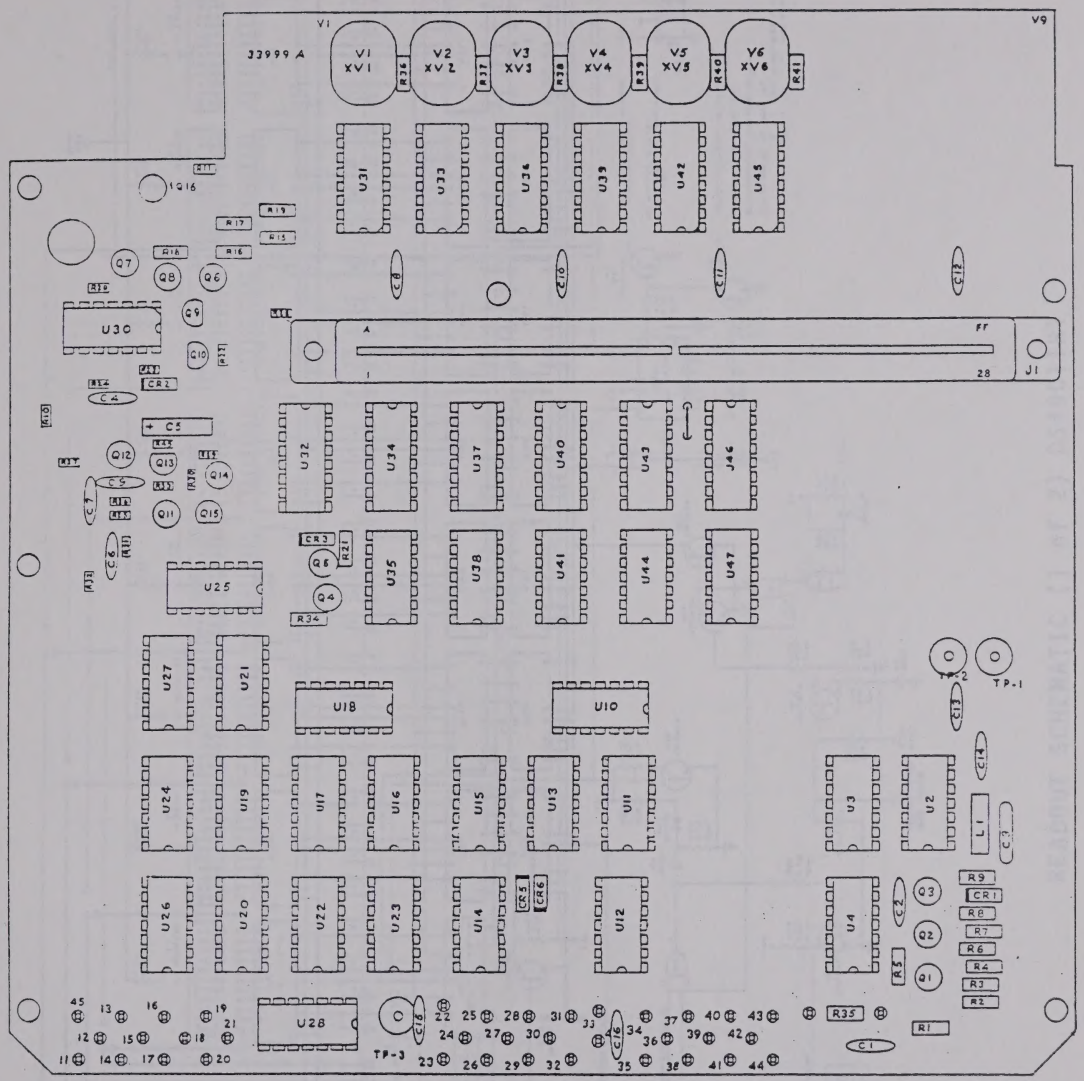
REF	DESCRIPTION	PART NO.
Y1	Oscillator	3715S1
XF1	Fuseholder	X0157
Z1	Filter, OSCC 2410-004	
Z2	Filter, OSCC 2410-004	
	Connector, 3 pin, PT Series (ship with J103)	30448
	Capacitor Connector (ZNC)	H1398
	Capacitor, Clamp	R0852
	Handle	H0047
	Filter	8100383
	Capacitor, Connector/N Series, Amphenol 82-108	XXXXX
	Connector, 44 Pin, P.C.	30240
	Chassis	8490I3
	Front Panel	849618
	Cover, Top	849017
	Fan Screen	823238
	Window Screen	823839
	Polarized Window	823840
	Cover, Bottom	849018
	Line Cord Assembly	823820
	Bottom Cover Screen	823821
	Filter Shield	823824



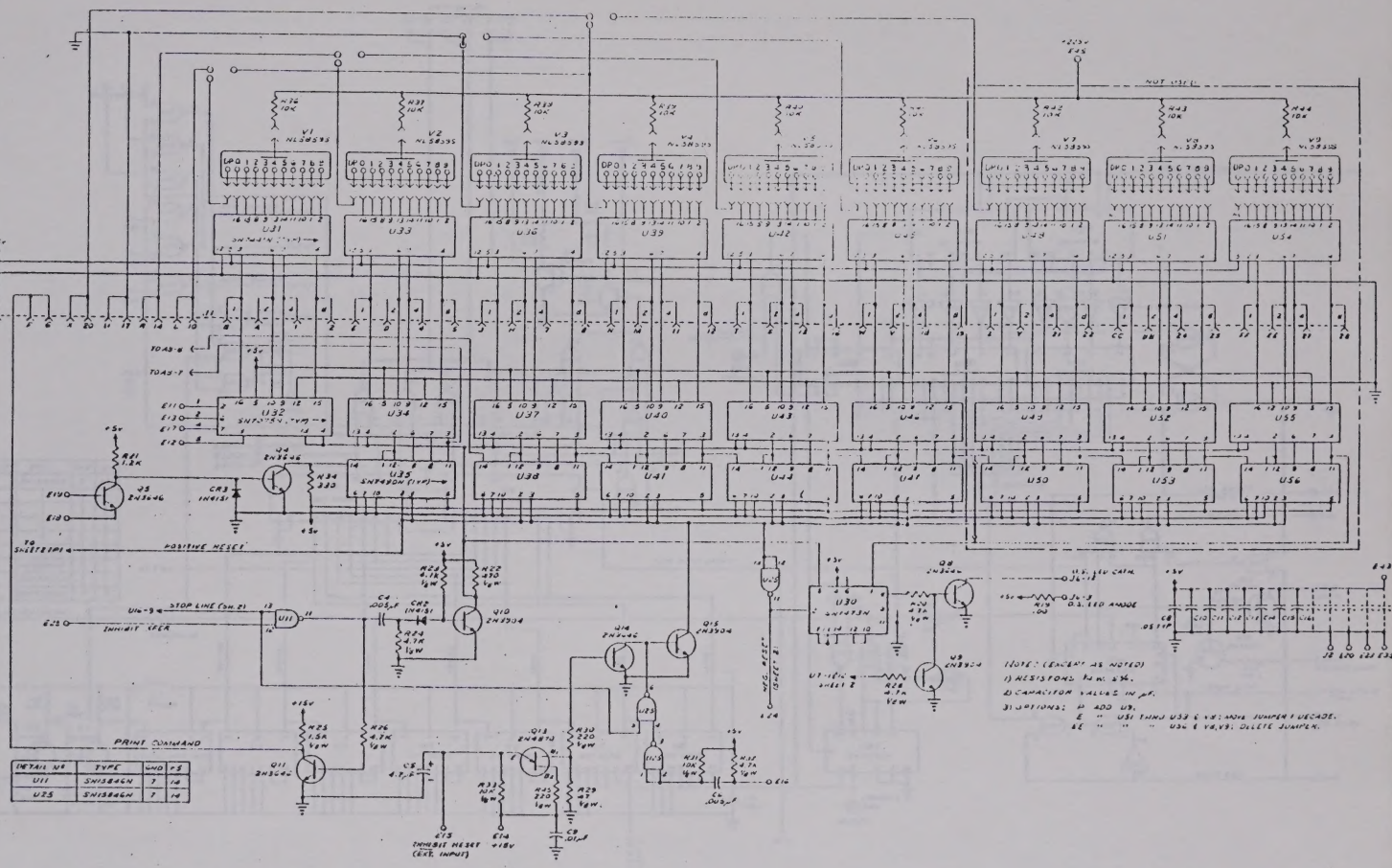
SHIELD BOARD ASSEMBLY CS49005R1

A2 SHIELD BOARD ASSEMBLY PARTS LIST

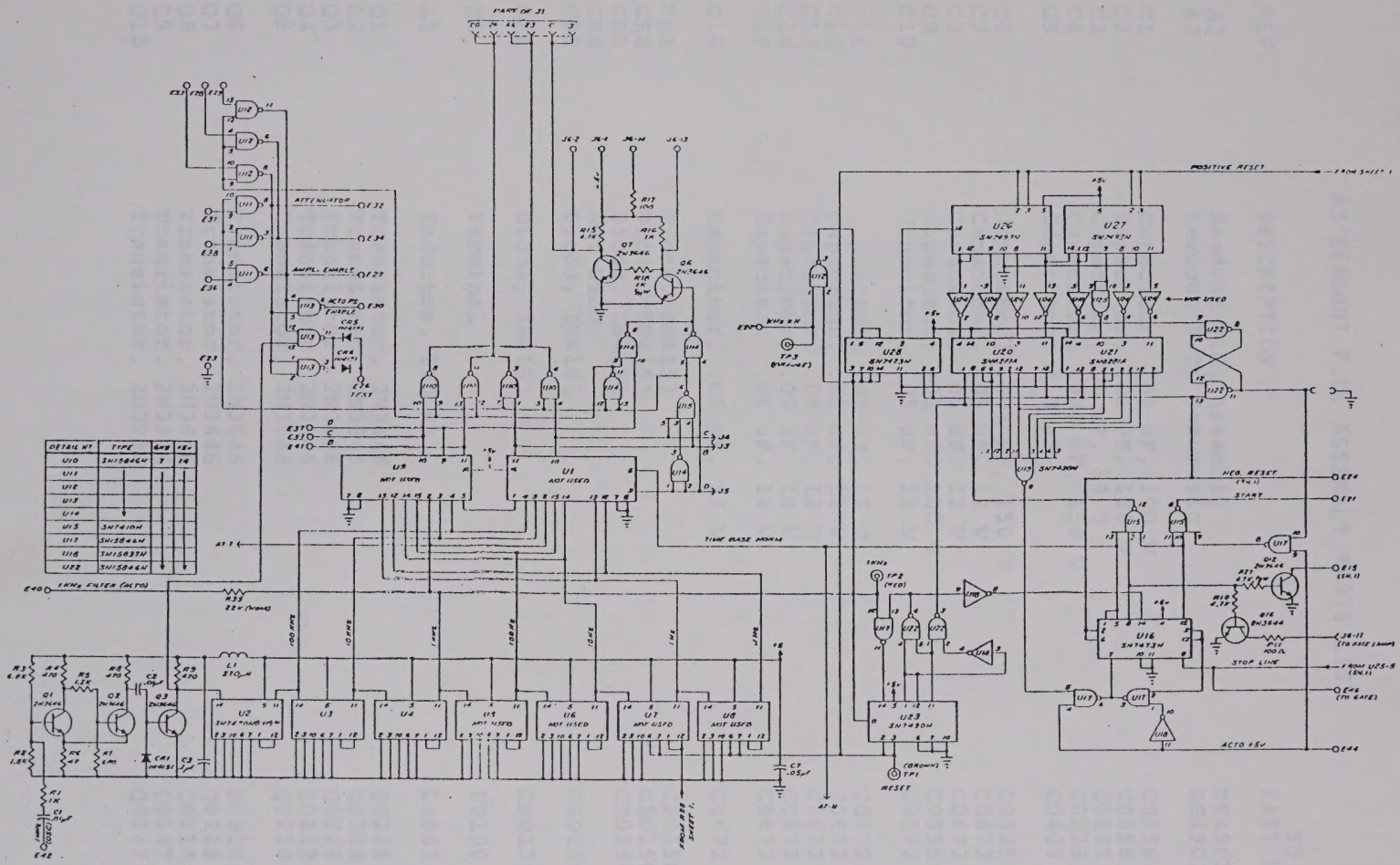
REF	DESCRIPTION	SD PART NO.
A2	Shield Board Assembly	C39448
A2	Shield Board Schematic	D39100
	Insulation, Power Traces	A39608
	Terminal Lug	E0100
	Spacer, Swage, 6-32 x .188	E0200
	Spacer, Swage, 6-32 x .31	H1684



READOUT P.C. ASSEMBLY DS49010R1



READOUT SCHEMATIC (1 of 2) DS49011R1



READOUT SCHEMATIC (2 of 2) DS49011R1

A3 READOUT P.C. ASSEMBLY PARTS LIST

REF.	DESCRIPTION	SD PART NO.
A3	Readout P.C. Assembly	DS49010
A3	Readout P.C. Schematic	DS49011
C1	Capacitor, .01 µF, 100 V	C0556
C2	Capacitor, .01 µF, 100 V	C0556
C3	Capacitor, .1 µF, 50 V	C0881
C4	Capacitor, .005 µF, 150 V	C0325
C5	Capacitor, 4.7 µF	C0406
C6	Capacitor, .005 µF, 150 V	C0325
C7	Capacitor, .05 µF, 12 V	C0672
C8	Capacitor, .05 µF, 12 V	C0672
C9	Capacitor, .01 µF, 100 V	C0556
C10	Capacitor, .05 µF, 12 V	C0672
C11	Capacitor, .05 µF, 12 V	C0672
C12	Capacitor, .05 µF, 12 V	C0672
C13	Capacitor, .05 µF, 12 V	C0672
C14	Capacitor, .05 µF, 12 V	C0672
C15	Capacitor, .05 µF, 12 V	C0672
C16	Capacitor, .05 µF, 12 V	C0672
CR1	Diode, IN4151	CR0150
CR2	Diode, IN4151	CR0150
CR3	Diode, IN4151	CR0150
CR4	NOT USED	
CR5	Diode, IN4151	CR0150
CR6	Diode, IN4151	CR0150
E1	Terminal	E0100
L1	Inductor, 270 µh	L0067
Q1	Transistor, 2N3646	Q0218
Q2	Transistor, 2N3646	Q0218
Q3	Transistor, 2N3646	Q0218
Q4	Transistor, 2N3646	Q0218
Q5	Transistor, 2N3646	Q0218
Q6	Transistor, 2N3646	Q0218
Q7	Transistor, 2N3646	Q0218
Q8	Transistor, 2N3646	Q0218
Q9	Transistor, 2N3904	Q0247
Q10	Transistor, 2N3904	Q0247

A3 BREADOUT P.C. ASSEMBLY PARTS LIST

REF.	DESCRIPTION	PART NO.
A3	Breadout P.C. Assembly	DB49010
A3	Breadout P.C. Schematic	DB49011
C1	Capacitor, .01 uF, 100 V	C0536
C2	Capacitor, .01 uF, 100 V	C0536
C3	Capacitor, .1 uF, 50 V	C0537
C4	Capacitor, .005 uF, 150 V	C0725
C5	Capacitor, 4.7 uF	C0406
C6	Capacitor, .005 uF, 150 V	C0725
C7	Capacitor, .05 uF, 12 V	C0672
C8	Capacitor, .05 uF, 12 V	C0672
C9	Capacitor, .01 uF, 100 V	C0536
C10	Capacitor, .05 uF, 12 V	C0672
C11	Capacitor, .05 uF, 12 V	C0672
C12	Capacitor, .05 uF, 12 V	C0672
C13	Capacitor, .05 uF, 12 V	C0672
C14	Capacitor, .05 uF, 12 V	C0672
C15	Capacitor, .05 uF, 12 V	C0672
C16	Capacitor, .05 uF, 12 V	C0672
CR1	Diode, IN4151	CR0150
CR2	Diode, IN4151	CR0150
CR3	Diode, IN4151	CR0150
CR4	NOT USED	
CR5	Diode, IN4151	CR0150
CR6	Diode, IN4151	CR0150
E1	Terminal	E0100
L1	Inductor, 270 uh	L0067
Q1	Transistor, 2N3646	Q0218
Q2	Transistor, 2N3646	Q0218
Q3	Transistor, 2N3646	Q0218
Q4	Transistor, 2N3646	Q0218
Q5	Transistor, 2N3646	Q0218
Q6	Transistor, 2N3646	Q0218
Q7	Transistor, 2N3646	Q0218
Q8	Transistor, 2N3646	Q0218
Q9	Transistor, 2N3904	Q0247
Q10	Transistor, 2N3904	Q0247

A3 READOUT P.C. ASSEMBLY PARTS LIST (Cont'd)

REF.	DESCRIPTION	SD PART NO.
Q11	Transistor, 2N3646	Q0218
Q12	Transistor, 2N3646	Q0218
Q13	Transistor, 2N4870	Q0266
Q14	Transistor, 2N3646	Q0218
Q15	Transistor, 2N3904	Q0247
Q16	Transistor, 2N3646	Q0218
R1	Resistor, 1 k, 1/4 W, 5%	R0765
R2	Resistor, 1.8 k, 1/4 W, 5%	R0959
R3	Resistor, 6.8 k, 1/4 W, 5%	R0696
R4	Resistor, 470 Ω, 1/4 W, 5%	R1044
R5	Resistor, 1.2 k, 1/4 W, 5%	R0809
R6	Resistor, 47 Ω, 1/4 W, 5%	R0743
R7	Resistor, 680 Ω, 1/4 W, 5%	R1234
R8	Resistor, 470 Ω, 1/4 W, 5%	R1044
R9	Resistor, 470 Ω, 1/4 W, 5%	R1044
R10	Resistor, 4.7 k, 1/8 W, 5%	R1733
R11	Resistor, 100 Ω, 1/4 W, 5%	R0966
R12	NOT USED	
R13	NOT USED	
R14	NOT USED	
R15	Resistor, 4.7 k, 1/4 W, 5%	R0892
R16	Resistor, 1 k, 1/4 W, 5%	R0765
R17	Resistor, 100 Ω, 1/4 W, 5%	R0966
R18	Resistor, 1 k, 1/4 W, 5%	R0765
R19	Resistor, 100 Ω, 1/4 W, 5%	R0966
R20	Resistor, 4.7 k, 1/8 W, 5%	R1733
R21	Resistor, 1.2 k, 1/4 W, 5%	R1044
R22	Resistor, 470 Ω, 1/8 W, 5%	R1451
R23	Resistor, 4.7 k, 1/8 W, 5%	R1733
R24	Resistor, 4.7 k, 1/8 W, 5%	R1733
R25	Resistor, 1.5 k, 1/8 W, 5%	R2463
R26	Resistor, 4.7 k, 1/8 W, 5%	R1733
R27	Resistor, 4.7 k, 1/8 W, 5%	R1733
R28	Resistor, 4.7 k, 1/8 W, 5%	R1733
R29	Resistor, 47 Ω, 1/8 W, 5%	R1449
R30	Resistor, 220 Ω, 1/8 W, 5%	R1743
R31	Resistor, 10 k, 1/8 W, 5%	R1437
R32	Resistor, 4.7 k, 1/8 W, 5%	R1733
R33	Resistor, 10 k, 1/8 W, 5%	R1437

REF.	DESCRIPTION	PART NO.
Q11	Transistor, 2N3646	C0212
Q12	Transistor, 2N3646	C0212
Q13	Transistor, 2N4870	C0268
Q14	Transistor, 2N3646	C0212
Q15	Transistor, 2N3904	C0247
Q16	Transistor, 2N3646	C0212
R1	Resistor, 1 K, 1/4 W, 5%	R0765
R2	Resistor, 1.8 K, 1/4 W, 5%	R0859
R3	Resistor, 8.8 K, 1/4 W, 5%	R0596
R4	Resistor, 470 Ω, 1/4 W, 5%	R1044
R5	Resistor, 1.5 K, 1/4 W, 5%	R0809
R6	Resistor, 47 Ω, 1/4 W, 5%	R0743
R7	Resistor, 680 Ω, 1/4 W, 5%	R1234
R8	Resistor, 470 Ω, 1/4 W, 5%	R1044
R9	Resistor, 470 Ω, 1/4 W, 5%	R1044
R10	Resistor, 4.7 K, 1/4 W, 5%	R1733
R11	Resistor, 100 Ω, 1/4 W, 5%	R0968
R12	NOT USED	
R13	NOT USED	
R14	NOT USED	
R15	Resistor, 4.7 K, 1/4 W, 5%	R0862
R16	Resistor, 1 K, 1/4 W, 5%	R0765
R17	Resistor, 100 Ω, 1/4 W, 5%	R0968
R18	Resistor, 1 K, 1/4 W, 5%	R0765
R19	Resistor, 100 Ω, 1/4 W, 5%	R0968
R20	Resistor, 4.7 K, 1/4 W, 5%	R1733
R21	Resistor, 1.2 K, 1/4 W, 5%	R1044
R22	Resistor, 470 Ω, 1/4 W, 5%	R1044
R23	Resistor, 4.7 K, 1/4 W, 5%	R1733
R24	Resistor, 4.7 K, 1/4 W, 5%	R1733
R25	Resistor, 1.5 K, 1/4 W, 5%	R0809
R26	Resistor, 4.7 K, 1/4 W, 5%	R1733
R27	Resistor, 4.7 K, 1/4 W, 5%	R1733
R28	Resistor, 4.7 K, 1/4 W, 5%	R1733
R29	Resistor, 47 Ω, 1/4 W, 5%	R1410
R30	Resistor, 220 Ω, 1/4 W, 5%	R1743
R31	Resistor, 10 K, 1/4 W, 5%	R1417
R32	Resistor, 4.7 K, 1/4 W, 5%	R1733
R33	Resistor, 10 K, 1/4 W, 5%	R1417

A3 READOUT P.C. ASSEMBLY PARTS LIST (Cont'd)

REF.	DESCRIPTION	SD PART NO.
R34	Resistor, 330 Ω, 1/4 W, 5%	R0662
R35	Resistor, 22 k, 1/4 W, 5%	R0768
R36	Resistor, 10 k, 1/4 W, 5%	R0766
R37	Resisotr, 10 k, 1/4 W, 5%	R0766
R38	Resistor, 10 k, 1/4 W, 5%	R0766
R39	Resistor, 10 k, 1/4 W, 5%	R0766
R40	Resistor, 10 k, 1/4 W, 5%	R0766
R41	Resistor, 10 k, 1/4 W, 5%	R0766
TP1	Test Point, Brown	E0284
TP2	Test Point, Red	E0279
TP3	Test Point, Orange	E0282
U1	NOT USED	
U2	Integrated Circuit, SN 7490N	25732
U3	Integrated Circuit, SN 7490N	25732
U4	Integrated Circuit, SN 7590N	25732
U5	NOT USED	
U6	NOT USED	
U7	NOT USED	
U8	NOT USED	
U9	NOT USED	
U10	Integrated Circuit, SN 15846	19716
U11	Integrated Circuit, SN 15846	19716
U12	Integrated Circuit, SN 15846	19716
U13	Integrated Circuit, SN 15846	19716
U14	Integrated Circuit, SN 15846	19716
U15	Integrated Circuit, SN 7410N	19706
U16	Integrated Circuit, SN 7473N	19709
U17	Integrated Circuit, SN 15846	19716
U18	Integrated Circuit, SN 15837N	25728
U19	Integrated Circuit, SN 7430N	25726
U20	Integrated Circuit, SN 8281A	25727
U21	Integrated Circuit, SN 8281A	25727
U22	Integrated Circuit, SN 15846	19716
U23	Integrated Circuit, SN 7490N	25732
U24	Integrated Circuit, SN 15837N	25728
U25	Integrated Circuit, SN 15846	19716
U26	Integrated Circuit, SN 7493N	25715
U27	Integrated Citcuit, SN 7493N	25715

REF.	DESCRIPTION	PART NO.
R14	Resistor, 330 Ω, 1/4 W, 5%	R0662
R15	Resistor, 22 K, 1/4 W, 5%	R0760
R16	Resistor, 10 K, 1/4 W, 5%	R0756
R17	Resistor, 10 K, 1/4 W, 5%	R0756
R18	Resistor, 10 K, 1/4 W, 5%	R0756
R19	Resistor, 10 K, 1/4 W, 5%	R0756
R20	Resistor, 10 K, 1/4 W, 5%	R0756
R21	Resistor, 10 K, 1/4 W, 5%	R0756
TP1	Test Point, Brown	Z0284
TP2	Test Point, Red	Z0273
TP3	Test Point, Orange	Z0283
U1	NOT USED	
U2	Integrated Circuit, SN 7490N	Z3732
U3	Integrated Circuit, SN 7490N	Z3732
U4	Integrated Circuit, SN 7990N	Z3732
U5	NOT USED	
U6	NOT USED	
U7	NOT USED	
U8	NOT USED	
U9	NOT USED	
U10	Integrated Circuit, SN 15846	Z3716
U11	Integrated Circuit, SN 15846	Z3716
U12	Integrated Circuit, SN 15846	Z3716
U13	Integrated Circuit, SN 15846	Z3716
U14	Integrated Circuit, SN 15846	Z3716
U15	Integrated Circuit, SN 7413N	Z3708
U16	Integrated Circuit, SN 7417N	Z3709
U17	Integrated Circuit, SN 15846	Z3716
U18	Integrated Circuit, SN 15832N	Z3724
U19	Integrated Circuit, SN 7420N	Z3726
U20	Integrated Circuit, SN 82S16	Z3727
U21	Integrated Circuit, SN 82S16	Z3727
U22	Integrated Circuit, SN 15846	Z3716
U23	Integrated Circuit, SN 7490N	Z3732
U24	Integrated Circuit, SN 15832N	Z3724
U25	Integrated Circuit, SN 15846	Z3716
U26	Integrated Circuit, SN 7493N	Z3713
U27	Integrated Circuit, SN 7493N	Z3713

A3 READOUT P.C. ASSEMBLY PARTS LIST (Cont'd)

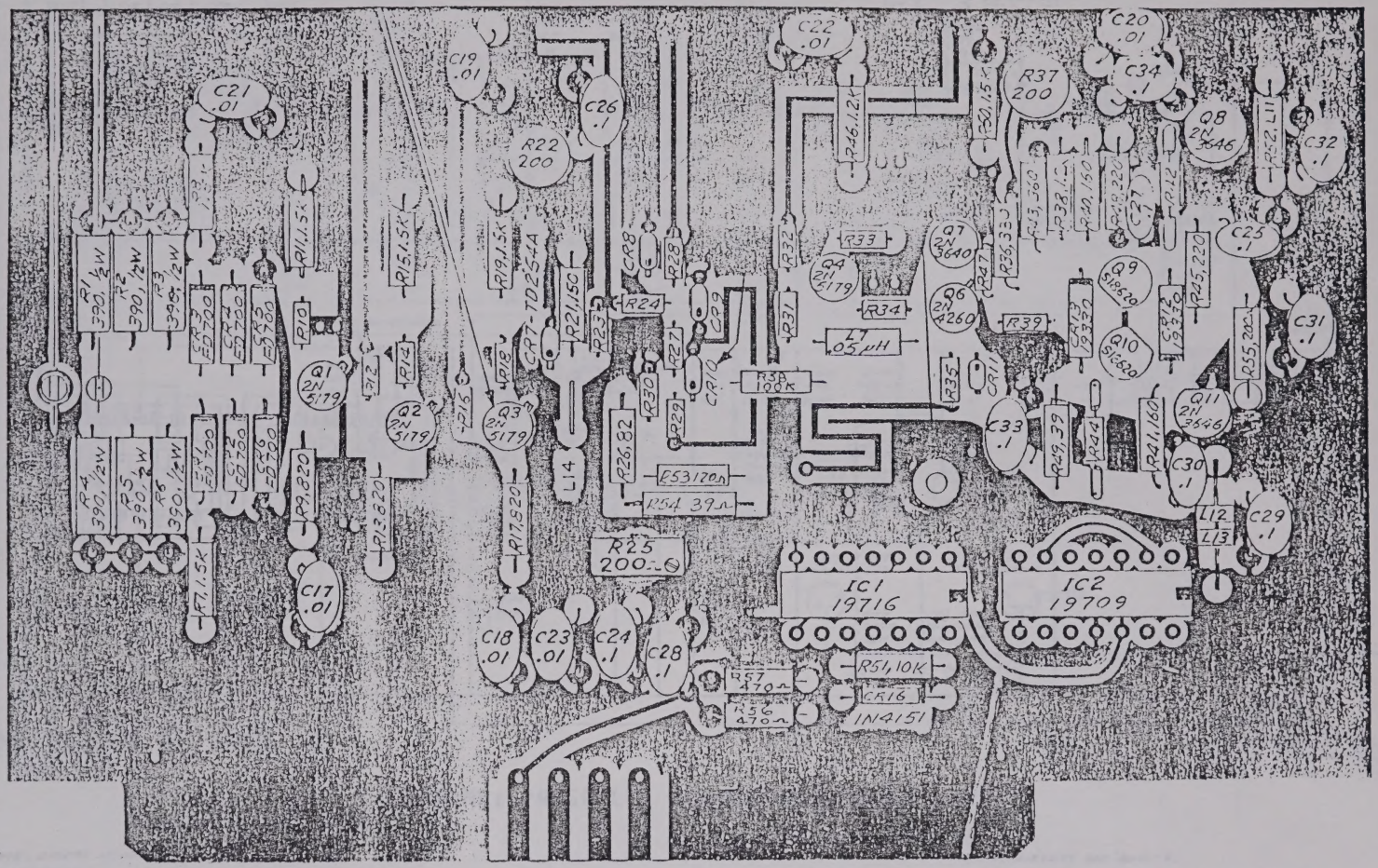
REF.	DESCRIPTION	SD PART NO.
U28	Integrated Circuit, SN7473N	19709
U29	NOT USED	
U30	Integrated Circuit, SN7473N	19709
U31	Integrated Circuit, SN7441N	19707
U32	Integrated Circuit, SN7075N	25731
U33	Integrated Circuit, SN7441N	19707
U34	Integrated Circuit, SN7075N	25731
U35	Integrated Circuit, SN7490N	19711
U36	Integrated Circuit, SN7441N	19707
U37	Integrated Circuit, SN7075N	25731
U38	Integrated Circuit, SN7490N	25732
U39	Integrated Circuit, SN7441N	19707
U40	Integrated Circuit, SN7075N	25731
U41	Integrated Circuit, SN7490N	25732
U42	Integrated Circuit, SN7441N	19707
U43	Integrated Circuit, SN7075N	25731
U44	Integrated Circuit, SN7490N	25732
U45	Integrated Circuit, SN7441N	19707
U46	Integrated Circuit, SN7075N	25731
U47	Integrated Circuit, SN7490N	25732
V1	Tube, Readout, NL5859S	V0131
V2	Tube, Readout, NL5859S	V0131
V3	Tube, Readout, NL5859S	V0131
V4	Tube, Readout, NL5859S	V0131
V5	Tube, Readout, NL5859S	V0131
V6	Tube, Readout, NL5859S	V0131
XU1	NOT USED	
XU2	Socket, IC, 7 Term	X0184
XU3	Socket, IC, 7 Term	X0184
XU4	Socket, IC, 7 Term	X0184
XU5	Socket, IC, 7 Term	X0184
XU6	Socket, IC, 7 Term	X0184
XU7	Socket, IC, 7 Term	X0184
XU8	Socket, IC, 7 Term	X0184
XU9	Socket, IC, 8 Term	X0185
XU10	Socket, IC, 7 Term	X0184
XU11	Socket, IC, 7 Term	X0184
XU12	Socket, IC, 7 Term	X0184

A3 BREADOUT P.C. ASSEMBLY PARTS LIST (Cont'd)

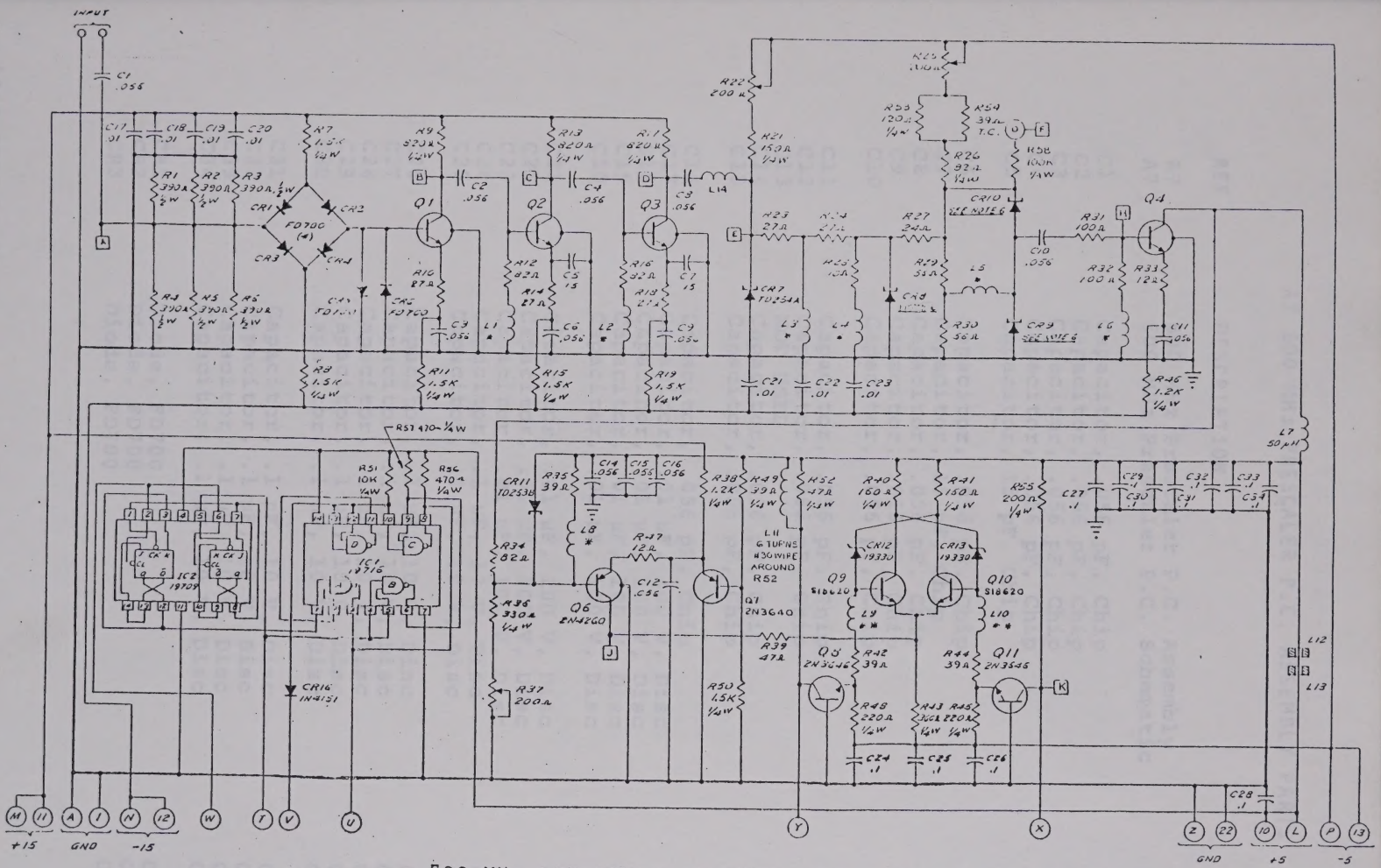
REF.	DESCRIPTION	PART NO.
U28	Integrated Circuit, SN74175N	19709
U29	MOX U28D	
U30	Integrated Circuit, SN74175N	19709
U31	Integrated Circuit, SN74161N	19707
U32	Integrated Circuit, SN7107SN	25731
U33	Integrated Circuit, SN74161N	19707
U34	Integrated Circuit, SN7107SN	25731
U35	Integrated Circuit, SN74150N	19711
U36	Integrated Circuit, SN74161N	19707
U37	Integrated Circuit, SN7107SN	25731
U38	Integrated Circuit, SN74150N	25732
U39	Integrated Circuit, SN74161N	19707
U40	Integrated Circuit, SN7107SN	25731
U41	Integrated Circuit, SN74150N	25732
U42	Integrated Circuit, SN74161N	19707
U43	Integrated Circuit, SN7107SN	25731
U44	Integrated Circuit, SN74150N	25732
U45	Integrated Circuit, SN74161N	19707
U46	Integrated Circuit, SN7107SN	25731
U47	Integrated Circuit, SN74150N	25732
V1	Tube, Readout, NL5835S	V0131
V2	Tube, Readout, NL5835S	V0131
V3	Tube, Readout, NL5835S	V0131
V4	Tube, Readout, NL5835S	V0131
V5	Tube, Readout, NL5835S	V0131
V6	Tube, Readout, NL5835S	V0131
XU1	NOT USED	
XU2	Socket, IC, 7 Term	X0184
XU3	Socket, IC, 7 Term	X0184
XU4	Socket, IC, 7 Term	X0184
XU5	Socket, IC, 7 Term	X0184
XU6	Socket, IC, 7 Term	X0184
XU7	Socket, IC, 7 Term	X0184
XU8	Socket, IC, 7 Term	X0184
XU9	Socket, IC, 8 Term	X0185
XU10	Socket, IC, 7 Term	X0184
XU11	Socket, IC, 7 Term	X0184
XU12	Socket, IC, 7 Term	X0184

A3 READOUT P.C. ASSEMBLY PARTS LIST (Cont'd)

REF	DESCRIPTION	SD PART NO.
XU13	Socket, IC, 7 Term	X0184
XU14	Socket, IC, 7 Term	X0184
XU15	Socket, IC, 7 Term	X0184
XU16	Socket, IC, 7 Term	X0184
XU17	Socket, IC, 7 Term	X0184
XU18	Socket, IC, 7 Term	X0184
XU19	Socket, IC, 7 Term	X0184
XU20	Socket, IC, 7 Term	X0184
XU21	Socket, IC, 7 Term	X0184
XU22	Socket, IC, 7 Term	X0184
XU23	Socket, IC, 7 Term	X0184
XU24	Socket, IC, 7 Term	X0184
XU25	Socket, IC, 7 Term	X0184
XU26	Socket, IC, 7 Term	X0184
XU27	Socket, IC, 7 Term	X0184
XU28	Socket, IC, 7 Term	X0184
XU29	NOT USED	
XU30	Socket, IC, 7 Term	X0184
XU31	Socket, IC, 8 Term	X0185
XU32	Socket, IC, 8 Term	X0185
XU33	Socket, IC, 8 Term	X0185
XU34	Socket, IC, 8 Term	X0185
XU35	Socket, IC, 7 Term	X0184
XU36	Socket, IC, 8 Term	X0185
XU37	Socket, IC, 8 Term	X0185
XU38	Socket, IC, 7 Term	X0184
XU39	Socket, IC, 8 Term	X0185
XU40	Socket, IC, 8 Term	X0185
XU41	Socket, IC, 7 Term	X0184
XU42	Socket, IC, 8 Term	X0185
XU43	Socket, IC, 8 Term	X0185
XU44	Socket, IC, 7 Term	X0184
XU45	Socket, IC, 8 Term	X0185
XU46	Socket, IC, 8 Term	X0185
XU47	Socket, IC, 7 Term	X0184
XV1	Socket, Tube, RTS-44	X0179
XV2	Socket, Tube, RTS-44	X0179
XV3	Socket, Tube, RTS-44	X0179
XV4	Socket, Tube, RTS-44	X0179
XV5	Socket, Tube, RTS-44	X0179
XV6	Socket, Tube, RTS-44	X0179



500 MHz PRESCALER P.C. ASSEMBLY C25536G



500 MHz PRESCALER SCHEMATIC D25533F

NOTE: EXCEPT AS NOTED.

1) RESISTORS:
POWER - - - - - 1/8 W.
TOL - - - - - - 5%.

2) CAPACITORS:
VALUE - - - - LESS THAN ONE IN pF.
" MORE " " " pF.

3) TRANSISTORS ARE 2N5179.

4) * - INDICATED CHOKES ARE PART OF PC PATTERN.
** - INDICATED CHOKES ARE RESISTOR PIGTAILS.
L12 & L13 ARE FERRITE BEADS, L14 = 1/2" LOOP 20 GA WIRE.

5) [A] = TEST POINTS REFERRED TO IN ALIGNMENT PROCEDURE 27782.

6) MATCHED SET PER 27960.

A7 500 MHz PRESCALER P.C. ASSEMBLY PARTS LIST

REF	DESCRIPTION	SD PART NO.
A7	500 MHz Prescaler P.C. Assembly	C25536
A7	500 MHz Prescaler P.C. Schematic	D25533
C1	Capacitor, .056 pF, Chip	C1164
C2	Capacitor, .056 pF, Chip	C1164
C3	Capacitor, .056 pF, Chip	C1164
C4	Capacitor, .056 pF, Chip	C1164
C5	Capacitor, 15 pF, Chip	C1163
C6	Capacitor, .056 pF, Chip	C1164
C7	Capacitor, 15 pF, Chip	C1163
C8	Capacitor, .056 pF, Chip	C1164
C9	Capacitor, .056 pF, Chip	C1164
C10	Capacitor, .056 pF, Chip	C1164
C11	Capacitor, .056 pF, Chip	C1164
C12	Capacitor, .056 pF, Chip	C1164
C13	NOT USED	
C14	Capacitor, .056 pF, Chip	C1164
C15	Capacitor, .056 pF, Chip	C1164
C16	Capacitor, .056 pF, Chip	C1164
C17	Capacitor, .01 µF, 100 V, Disc	C0556
C18	Capacitor, .01 µF, 100 V, Disc	C0556
C19	Capacitor, .01 µF, 100 V, Disc	C0556
C20	Capacitor, .01 µF, 100 V, Disc	C0556
C21	Capacitor, .01 µF, 100 V, Disc	C0556
C22	Capacitor, .01 µF, 100 V, Disc	C0556
C23	Capacitor, .01 µF, 100 V, Disc	C0556
C24	Capacitor, .1 µF, 10 V, Disc	C0661
C25	Capacitor, .1 µF, 10 V, Disc	C0661
C26	Capacitor, .1 µF, 10 V, Disc	C0661
C27	Capacitor, .1 µF, 10 V, Disc	C0661
C28	Capacitor, .1 µF, 10 V, Disc	C0661
C29	Capacitor, .1 µF, 10 V, Disc	C0661
C30	Capacitor, .1 µF, 10 V, Disc	C0661
C31	Capacitor, .1 µF, 10 V, Disc	C0661
C32	Capacitor, .1 µF, 10 V, Disc	C0661
C33	Capacitor, .1 µF, 10 V, Disc	C0661
C34	Capacitor, .1 µF, 10 V, Disc	C0661
CR1	Diode, FD700	CR0356
CR2	Diode, FD700	CR0356
CR3	Diode, FD700	CR0356

REF	DESCRIPTION	PART NO.
A1	500 MHz Prescaler P.C. Assembly	C23234
A1	500 MHz Prescaler P.C. Schematic	D23234
C1	Capacitor, .056 pF, Chip	C1164
C2	Capacitor, .056 pF, Chip	C1164
C3	Capacitor, .056 pF, Chip	C1164
C4	Capacitor, .056 pF, Chip	C1164
C5	Capacitor, 15 pF, Chip	C1163
C6	Capacitor, .056 pF, Chip	C1164
C7	Capacitor, 15 pF, Chip	C1163
C8	Capacitor, .056 pF, Chip	C1164
C9	Capacitor, .056 pF, Chip	C1164
C10	Capacitor, .056 pF, Chip	C1164
C11	Capacitor, .056 pF, Chip	C1164
C12	Capacitor, .056 pF, Chip	C1164
C13	5.6 Ohms	
C14	Capacitor, .056 pF, Chip	C1164
C15	Capacitor, .056 pF, Chip	C1164
C16	Capacitor, .056 pF, Chip	C1164
C17	Capacitor, .01 uF, 100 V, Disc	C0356
C18	Capacitor, .01 uF, 100 V, Disc	C0356
C19	Capacitor, .01 uF, 100 V, Disc	C0356
C20	Capacitor, .01 uF, 100 V, Disc	C0356
C21	Capacitor, .01 uF, 100 V, Disc	C0356
C22	Capacitor, .01 uF, 100 V, Disc	C0356
C23	Capacitor, .01 uF, 100 V, Disc	C0356
C24	Capacitor, .1 uF, 10 V, Disc	C0661
C25	Capacitor, .1 uF, 10 V, Disc	C0661
C26	Capacitor, .1 uF, 10 V, Disc	C0661

A7 500 MHz PRESCALER P.C. ASSEMBLY PARTS LIST (Cont'd)

REF	DESCRIPTION	SD PART NO.
CR4	Diode, FD700	CR0356
CR5	Diode, FD700	CR0356
CR6	Diode, FD700	CR0356
CR7	Diode, TD254A	CR0360
CR8	Diode, TD253B, Matched Set A27960	CR0357
CR9	Diode, TD253B, Matched Set A27960	CR0357
CR10	Diode, TD253B, Matched Set A27960	CR0357
CR11	Diode, TD253B	CR0357
CR12	Diode, 19330	A19330
CR13	Diode, 19330	A19330
CR14	NOT USED	
CR15	NOT USED	
CR16	Diode, IN4151	CR0150
IC1	Integrated Circuit, SN15846N	19716
IC2	Integrated Circuit, SN7473N	19709
L1	Trace Pattern, Part of P.C. Board	
L2	Trace Pattern, Part of P.C. Board	
L3	Trace Pattern, Part of P.C. Board	
L4	Trace Pattern, Part of P.C. Board	
L5	Trace Pattern, Part of P.C. Board	
L6	Trace Pattern, Part of P.C. Board	
L7	Inductor, .05 µH	L0159
L8	Trace Pattern, Part of P.C. Board	
L9	Inductor, Part of R42	
L10	Inductor, Part of R44	
L11	Peaking Network	A27927
L12	Ferrite Bead	H0654
L13	Ferrite Bead	H0654
L14	Bare Wire, 1/2" Loop	
Q1	Transistor, 2N5179	Q0269
Q2	Transistor, 2N5179	Q0269
Q3	Transistor, 2N5179	Q0269
Q4	Transistor, 2N5179	Q0269
Q5	NOT USED	
Q6	Transistor, 2N4260	Q0272
Q7	Transistor, 2N3640	Q0178
Q8	Transistor, 2N3646	Q0218
Q9	Transistor, S18620	26003581
Q10	Transistor, S18620	26003581

REF	DESCRIPTION	PART NO.
CR4	Diode, FD700	CR0356
CR5	Diode, FD700	CR0356
CR6	Diode, FD700	CR0356
CR7	Diode, TD1744	CR0360
CR8	Diode, TD2328, Matched Set AZ1960	CR0357
CR9	Diode, TD2328, Matched Set AZ1960	CR0357
CR10	Diode, TD2328, Matched Set AZ1960	CR0357
CR11	Diode, TD2328	CR0357
CR12	Diode, 1N270	AL9330
CR13	Diode, 1N270	AL9330
CR14	NOT USED	
CR15	NOT USED	
CR16	Diode, 1N1181	CR0150
IC1	Integrated Circuit, SN75450N	19718
IC2	Integrated Circuit, SN74174N	19709
L1	Trace Pattern, Part of P.C. Board	
L2	Trace Pattern, Part of P.C. Board	
L3	Trace Pattern, Part of P.C. Board	
L4	Trace Pattern, Part of P.C. Board	
L5	Trace Pattern, Part of P.C. Board	
L6	Trace Pattern, Part of P.C. Board	
L7	Inductor, .05 uH	CO139
L8	Trace Pattern, Part of P.C. Board	
L9	Inductor, Part of R42	
L10	Inductor, Part of R44	
L11	Peaking Network	AZ7527
L12	Ferrite Bead	B0814
L13	Ferrite Bead	B0814
L14	Bare Wire, 1/2" Loop	
Q1	Transistor, 2N5179	Q0248
Q2	Transistor, 2N5179	Q0248
Q3	Transistor, 2N5179	Q0248
Q4	Transistor, 2N5179	C0248
Q5	NOT USED	
Q6	Transistor, 2N4260	Q0272
Q7	Transistor, 2N3640	Q0178
Q8	Transistor, 2N3646	Q0218
Q9	Transistor, 81B620	2600358I
Q10	Transistor, 81B620	2600358I

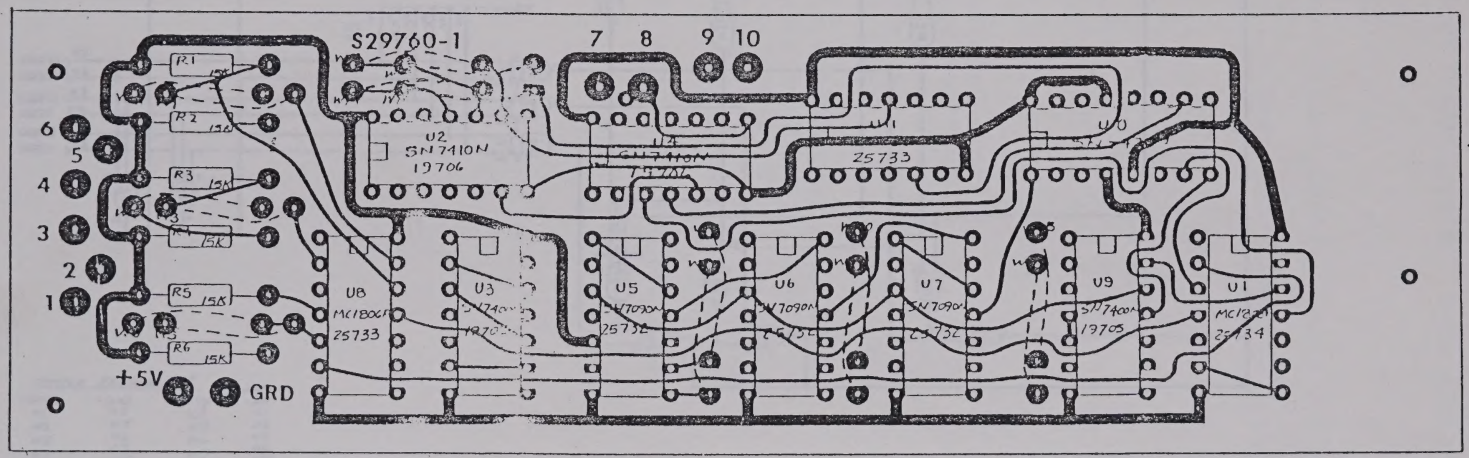
[illegible] P.C. ASSEMBLY PARTS LIST (Cont'd)

REF	DESCRIPTION	SD PART NO.
Q11	Transistor, 2N3646	Q0218
R1	Resistor, 390 Ω, 1/2 W, 5%	R0322
R2	Resistor, 390 Ω, 1/2 W, 5%	R0322
R3	Resistor, 390 Ω, 1/2 W, 5%	R0322
R4	Resistor, 390 Ω, 1/2 W, 5%	R0322
R5	Resistor, 390 Ω, 1/2 W, 5%	R0322
R6	Resistor, 390 Ω, 1/2 W, 5%	R0322
R7	Resistor, 1.5 k, 1/4 W, 5%	R0783
R8	Resistor, 1.5 k, 1/4 W, 5%	R0783
R9	Resistor, 820 Ω, 1/4 W, 5%	R0762
R10	Resistor, 27 Ω, 1/8 W, 5%	R1825
R11	Resistor, 1.5 k, 1/4 W, 5%	R0783
R12	Resistor, 82 Ω, 1/8 W, 5%	R1745
R13	Resistor, 820 Ω, 1/4 W, 5%	R0762
R14	Resistor, 27 Ω, 1/8 W, 5%	R1825
R15	Resistor, 1.5 k, 1/4 W, 5%	R0783
R16	Resistor, 82 Ω, 1/8 W, 5%	R1745
R17	Resistor, 820 Ω, 1/4 W, 5%	R0762
R18	Resistor, 27 Ω, 1/8 W, 5%	R1825
R19	Resistor, 1.5 k, 1/4 W, 5%	R0783
R20	NOT USED	
R21	Resistor, 150 Ω, 1/4 W, 5%	R0983
R22	Resistor, 200 Ω, Potentiometer, S.T.	R2394
R23	Resistor, 27 Ω, 1/8 W, 5%	R1825
R24	Resistor, 27 Ω, 1/8 W, 5%	R1825
R25	Resistor, 200 Ω, Potentiometer	R2425
R26	Resistor, 82 Ω, 1/4 W, 5%	R1059
R27	Resistor, 24 Ω, 1/8 W, 5%	R1824
R28	Resistor, 10 Ω, 1/8 W, 5%	R1866
R29	Resistor, 56 Ω, 1/8 W, 5%	R1833
R30	Resistor, 56 Ω, 1/8 W, 5%	R1833
R31	Resistor, 100 Ω, 1/8 W, 5%	R1441
R32	Resistor, 100 Ω, 1/8 W, 5%	R1441
R33	Resistor, 12 Ω, 1/8 W, 5%	R1840
R34	Resistor, 82 Ω, 1/8 W, 5%	R1745
R35	Resistor, 39 Ω, 1/8 W, 5%	R1829
R36	Resistor, 330 Ω, 1/4 W, 5%	R0662
R37	Resistor, 200 Ω, Potentiometer, S.T.	R2394
R38	Resistor, 1.2 k, 1/4 W, 5%	R0809

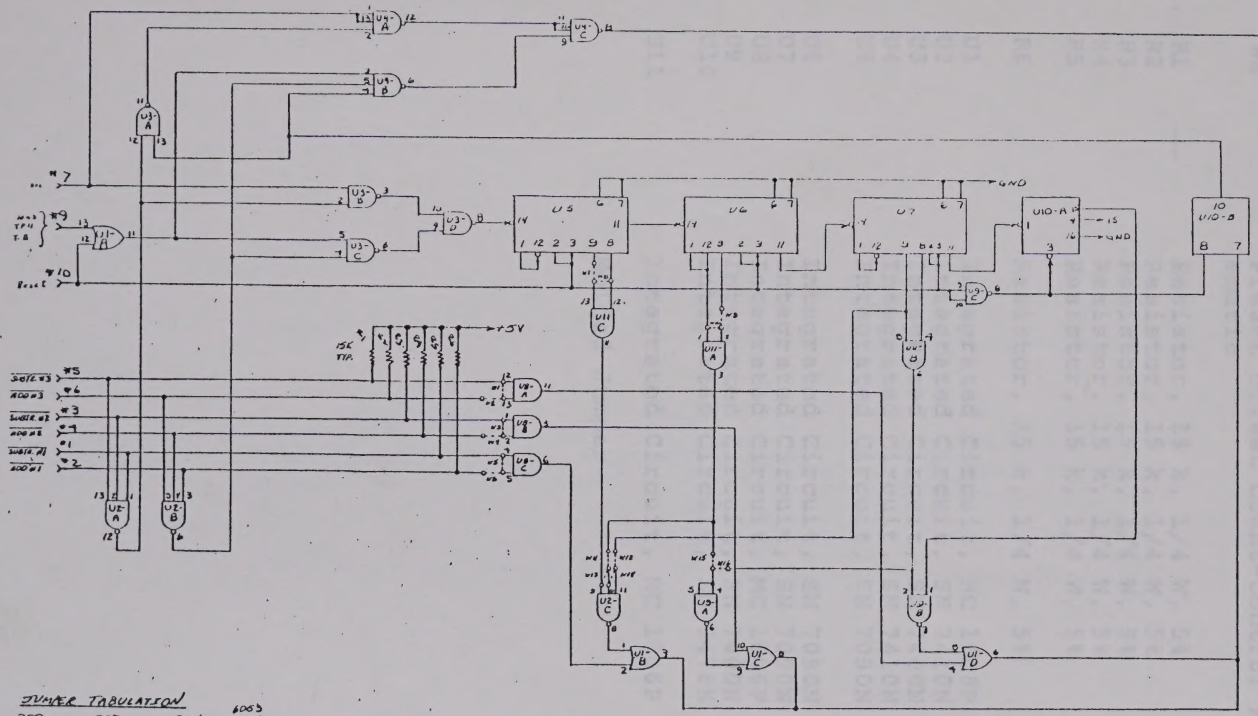
A7 500 MHz PRESCALER P.C. ASSEMBLY PARTS LIST (Cont'd)

REF	DESCRIPTION	SD PART NO.
R39	Resistor, 47 Ω, 1/8 W, 5%	R1449
R40	Resistor, 160 Ω, 1/4 W, 5%	R1572
R41	Resistor, 160 Ω, 1/4 W, 5%	R1572
R42	Resistor, 39 Ω, 1/8 W, 5%	R1829
R43	Resistor, 360 Ω, 1/4 W, 5%	R1571
R44	Resistor, 39 Ω, 1/8 W, 5%	R1829
R45	Resistor, 220 Ω, 1/4 W, 5%	R0760
R46	Resistor, 1.2 k, 1/4 W, 5%	R0809
R47	Resistor, 12 Ω, 1/8 W, 5%	R1840
R48	Resistor, 220 Ω, 1/4 W, 5%	R0760
R49	Resistor, 39 Ω, 1/4 W, 5%	R1552
R50	Resistor, 1.5 k, 1/4 W, 5%	R0783
R51	Resistor, 10 k, 1/4 W, 5%	R0766
R52	Part of L 11	
R53	Resistor, 120 Ω, 1/4 W, 5%	R1461
R54	Resistor, 39 Ω, 1/8 TM	R2447
R55	Resistor, 200 Ω, 1/4 W, 5%	R0736
R56	Resistor, 470 Ω, 1/4 W, 5%	R1044
R57	Resistor, 470 Ω, 1/4 W, 5%	R1044
R58	Resistor, 100 k, 1/4 W, 5%	R0741

REF	DESCRIPTION	PART NO.
R39	Resistor, 47 Ω, 1/8 W, 5%	R1449
R40	Resistor, 150 Ω, 1/4 W, 5%	R1572
R41	Resistor, 150 Ω, 1/4 W, 5%	R1572
R42	Resistor, 39 Ω, 1/8 W, 5%	R1829
R43	Resistor, 560 Ω, 1/4 W, 5%	R1571
R44	Resistor, 10 Ω, 1/8 W, 5%	R1829
R45	Resistor, 220 Ω, 1/4 W, 5%	R0760
R46	Resistor, 1.2 K, 1/4 W, 5%	R0809
R47	Resistor, 12 Ω, 1/8 W, 5%	R1840
R48	Resistor, 120 Ω, 1/4 W, 5%	R0750
R49	Resistor, 39 Ω, 1/4 W, 5%	R1832
R50	Resistor, 1.5 K, 1/4 W, 5%	R0783
R51	Resistor, 10 K, 1/4 W, 5%	R0766
R52	Part of L 11	
R53	Resistor, 120 Ω, 1/4 W, 5%	R1461
R54	Resistor, 39 Ω, 1/8 1M	R2447
R55	Resistor, 200 Ω, 1/4 W, 5%	R0736
R56	Resistor, 470 Ω, 1/4 W, 5%	R1044
R57	Resistor, 470 Ω, 1/4 W, 5%	R1044
R58	Resistor, 100 K, 1/4 W, 5%	R0741



PRESET OFFSET COUNT & CONTROL P.C. ASSEMBLY DS29761R2



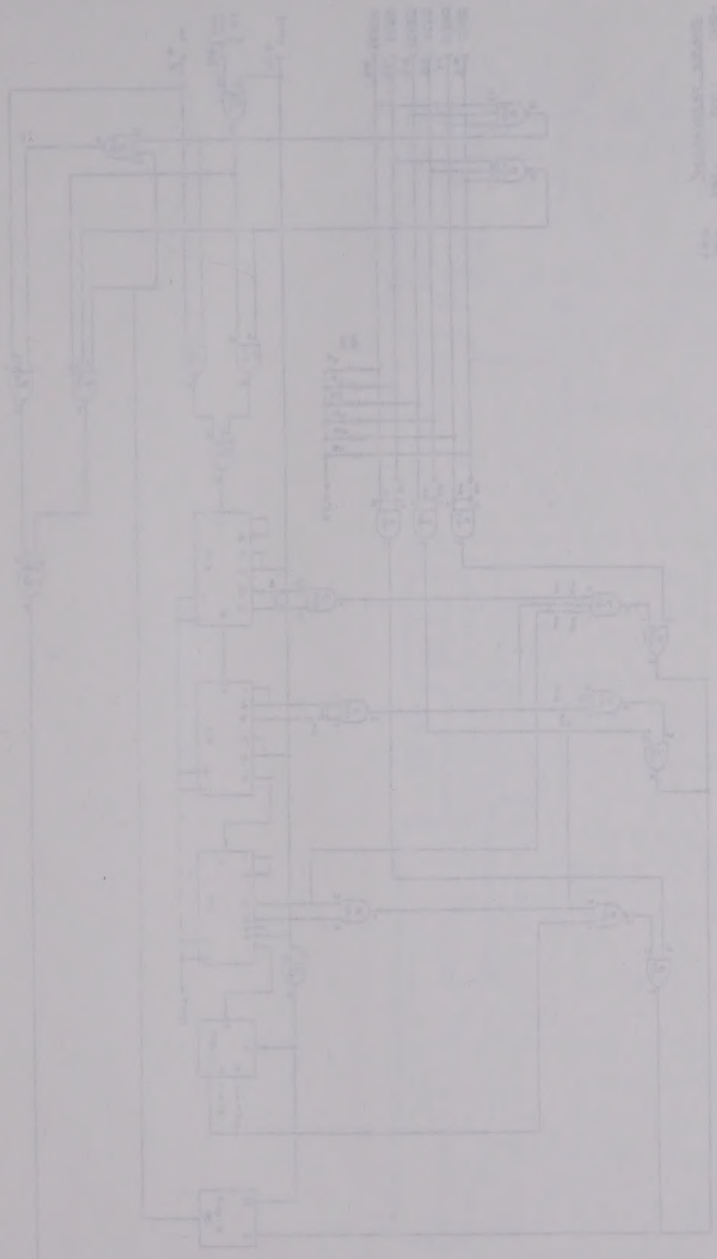
JUMPER TABULATION

-300	-303	-304	6053 -304
W1	W2	W1	W1
W3	W4	W3	W3
W5	W6	W6	W5
W7	W8	W7	W8
W9	W10	W10	W10
W11	W11	W11	W11
W13	W12	W11	W12
W14	W16	W14	W16
W15			

Do not install U7 on 6316-300 & 6316-304

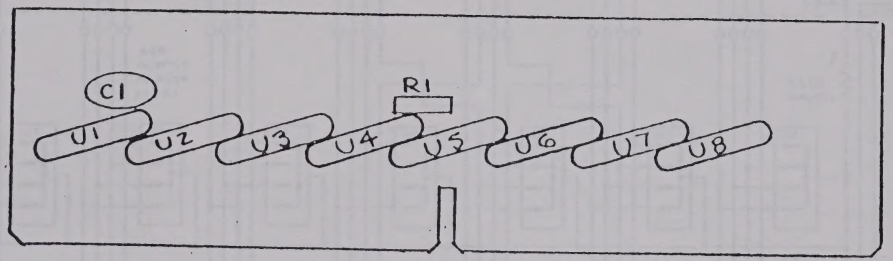
U1	= MC 1809 P	25734	PIN 14 = +5, PIN 7 = GND
U2,4	= SN 7410N	19706	4IN 1C1
U3,9	= SN 7400N	19705	5/A 1C1
U5,6,7	= SN 7490N	25722	PINS = +5, PIN 10 = GND
U8,11	= MC 1806 P	25733	3/A 1C1
U10	= SN 7476N		PIN 5 = +5, PIN 13 = GND

PRESET OFFSET COUNT & CONTROL P.C. SCHEMATIC DS29758R2

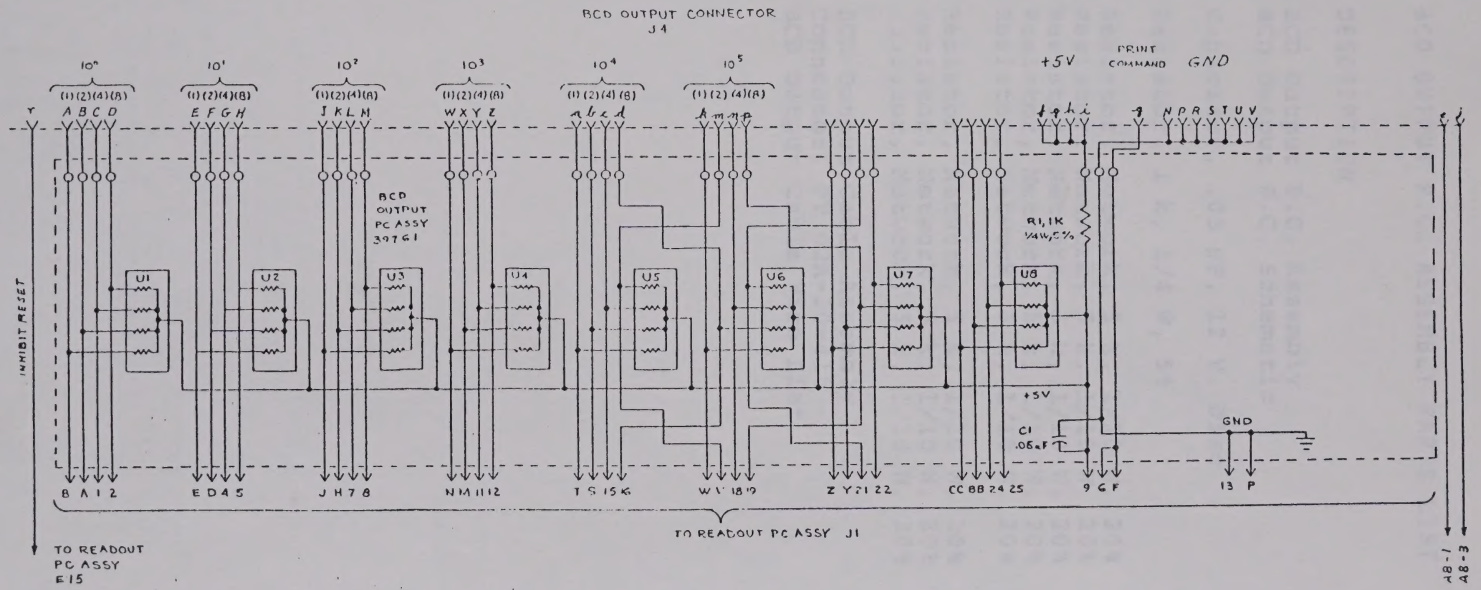


A8 PRESET OFFSET COUNT-CONTROL P.C. ASSEMBLY PARTS LIST

REF.	DESCRIPTION	SD PART NO.
A8	Preset Offset Count-Control P.C. Assembly	DS29761
A8	Preset Offset Count-Control P.C. Schematic	DS29758
R1	Resistor, 15 k, 1/4 W, 5%	R0728
R2	Resistor, 15 k, 1/4 W, 5%	R0728
R3	Resistor, 15 k, 1/4 W, 5%	R0728
R4	Resistor, 15 k, 1/4 W, 5%	R0728
R5	Resistor, 15 k, 1/4 W, 5%	R0728
R6	Resistor, 15 k, 1/4 W, 5%	R0728
U1	Integrated Circuit, MC 1808P	25734
U2	Integrated Circuit, SN 7410N	19706
U3	Integrated Circuit, SN 7400N	19705
U4	Integrated Circuit, SN 7410N	19706
U5	Integrated Circuit, SN 7090N	25732
U6	Integrated Circuit, SN 7090N	25732
U7	Integrated Circuit, SN 7090N	25732
U8	Integrated Circuit, MC 1806P	25733
U9	Integrated Circuit, SN 7400N	19705
U10	Integrated Circuit, SN 7476N	
U11	Integrated Circuit, MC 1806P	25733
	Molded Jumper	W0087



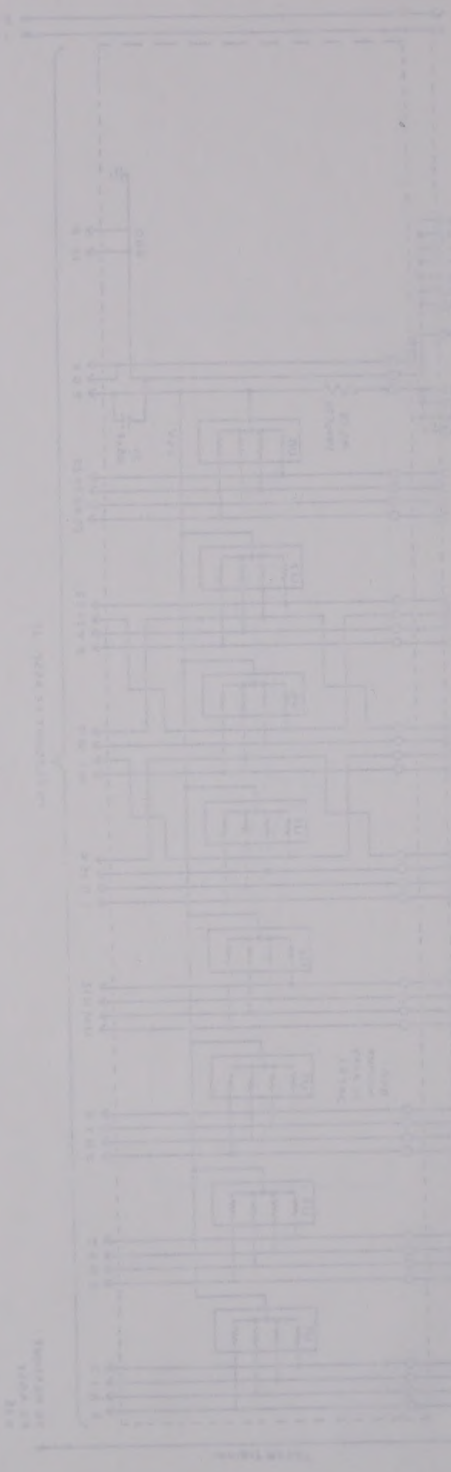
BCD OUTPUT P.C. ASSEMBLY AS49006R1



NOTES

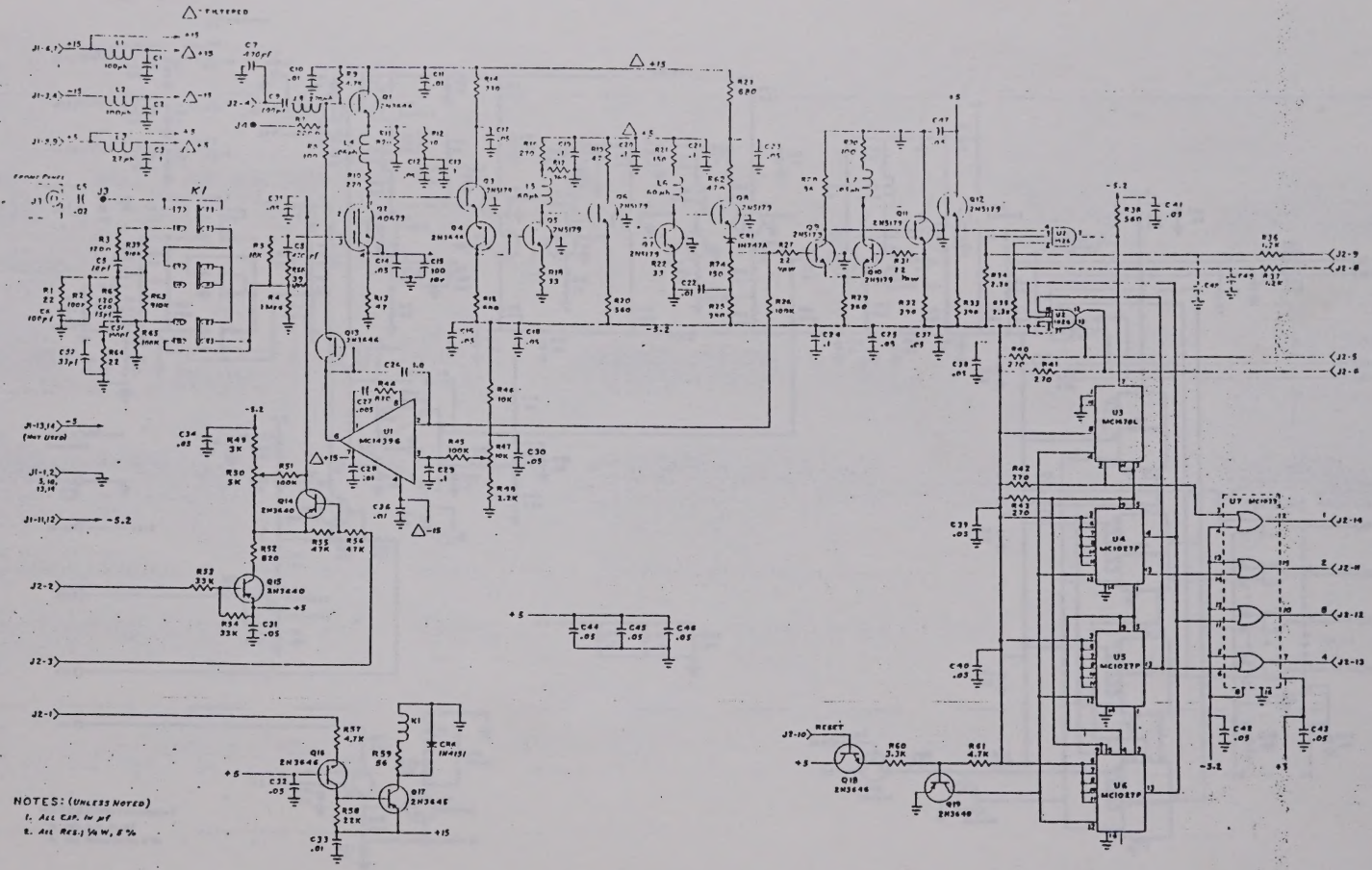
1) U1 THRU U8 ARE 5K, 1/10W, 20% RESISTOR NETWORKS 278G7
2) U9 & U10 ARE SN15846N OR EQUIV. PIN 7 GND, PIN 14 +5V
3) REF. A 529850 PIN ASSIGNMENT SPEC.

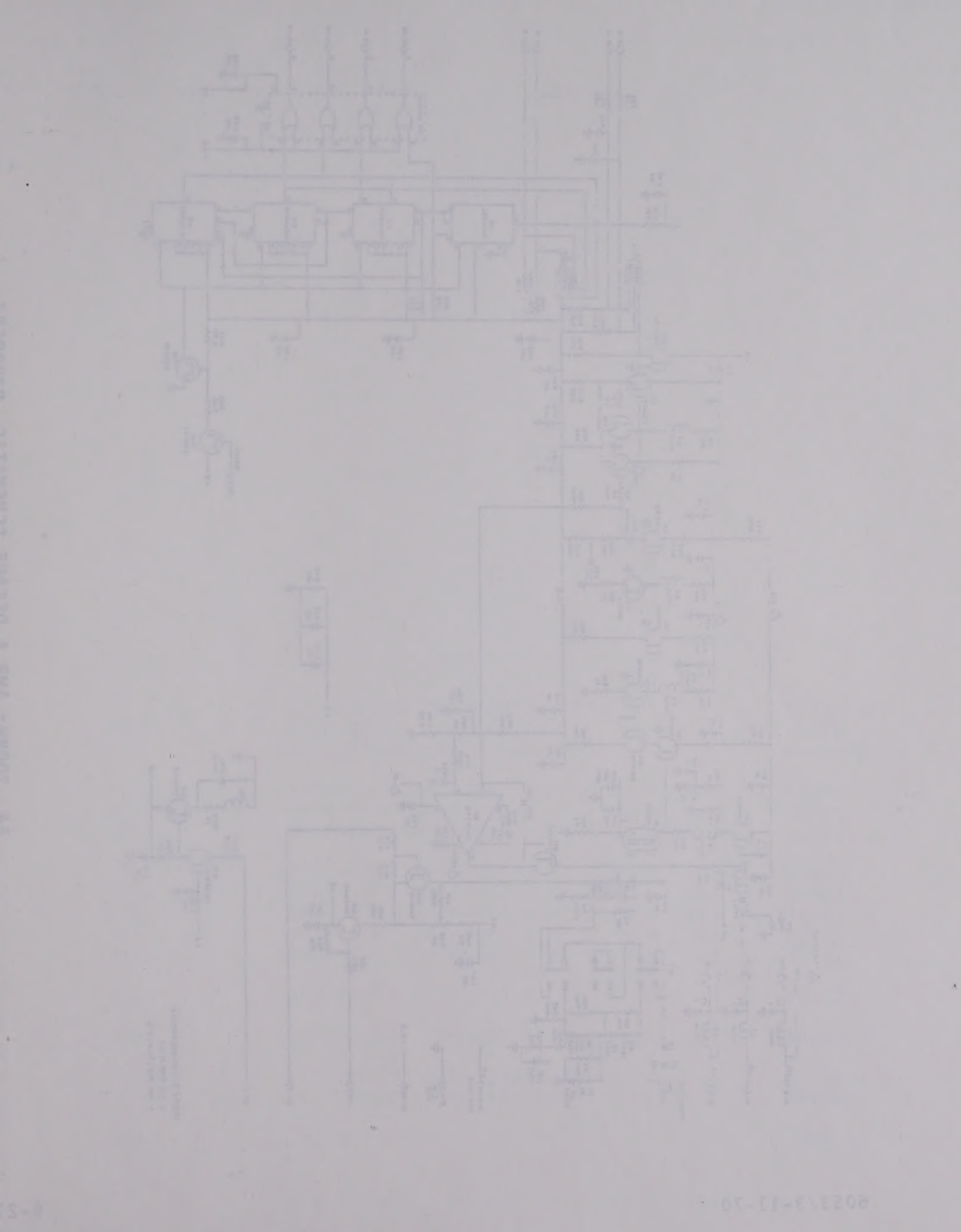
BCD OUTPUT SCHEMATIC CS49007R2

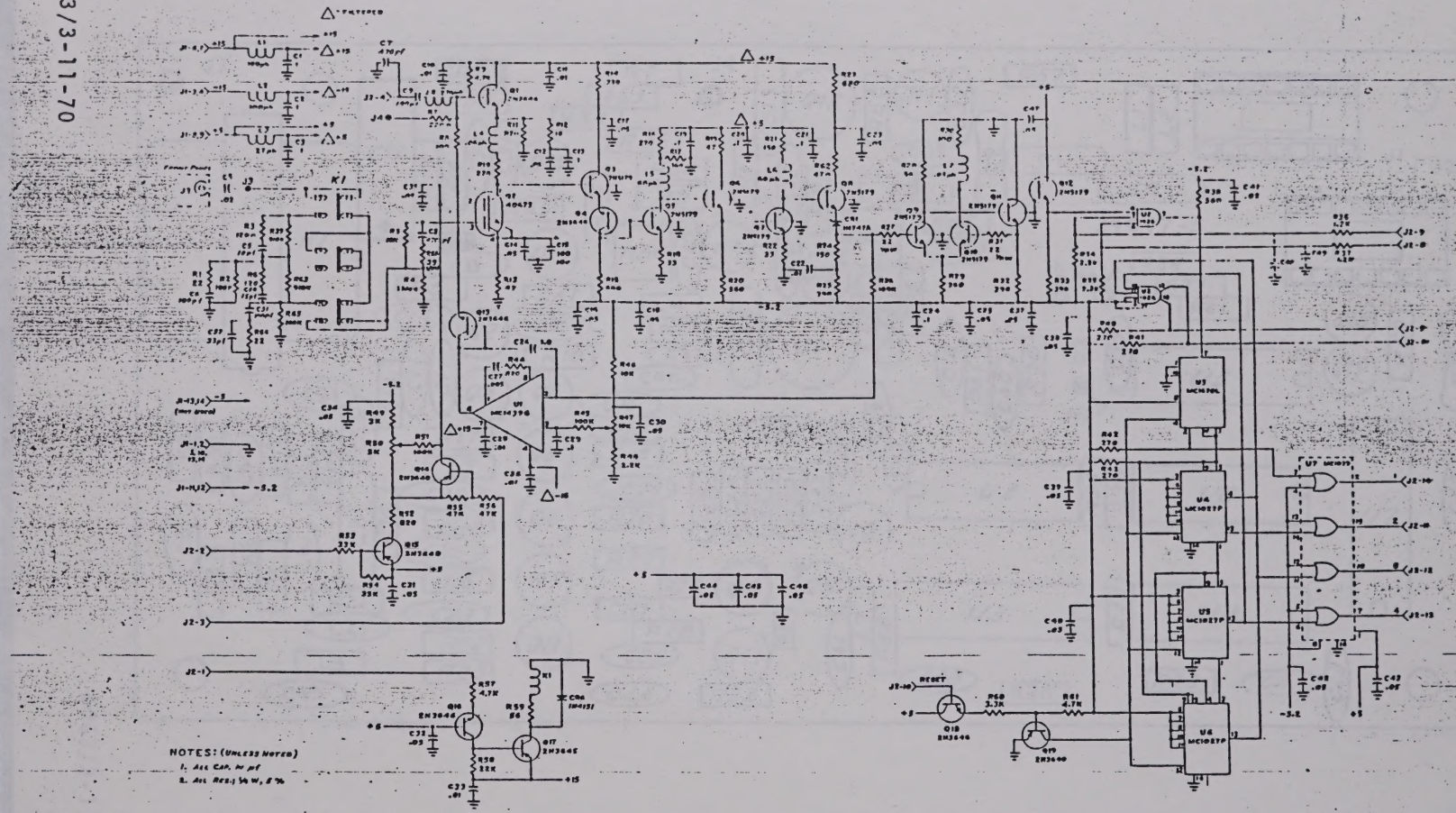


BCD OUTPUT P.C. ASSEMBLY PARTS LIST

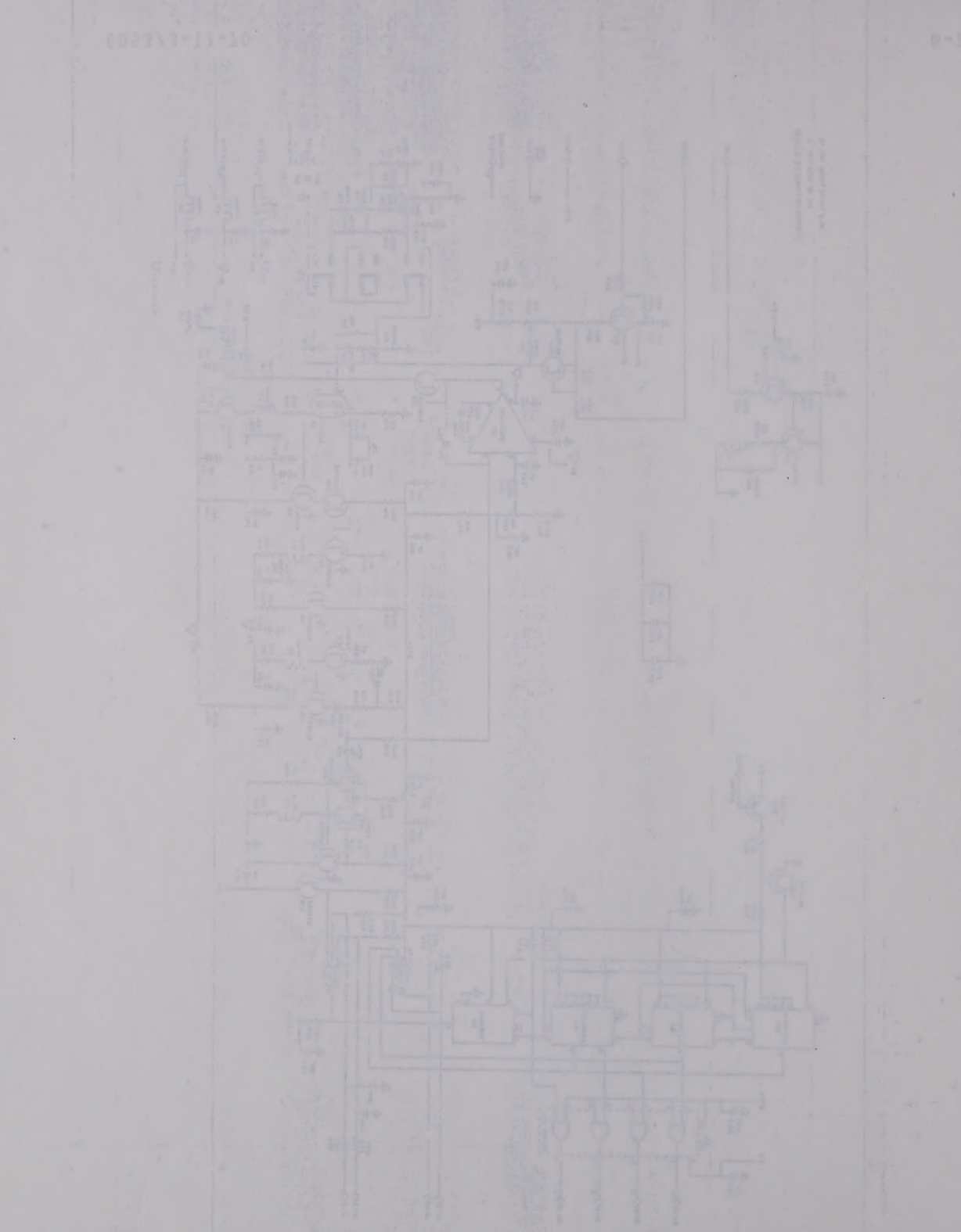
REF.	DESCRIPTION	SD PART NO.
	BCD Output P.C. Assembly	AS49006
	BCD Output P.C. Schematic	CS49007
C1	Capacitor, .05 µF, 12 V, Disc	C0762
R1	Resistor, 1 k, 1/4 W, 5%	R0765
U1	Resistor, Network, 5 k, 1/10 W, 20%	27867
U2	Resistor, Network, 5 k, 1/10 W, 20%	27867
U3	Resistor, Network, 5 k, 1/10 W, 20%	27867
U4	Resistor, Network, 5 k, 1/10 W, 20%	27867
U5	Resistor, Network, 5 k, 1/10 W, 20%	27867
U6	Resistor, Network, 5 k, 1/10 W, 20%	27867
U7	Resistor, Network, 5 k, 1/10 W, 20%	27867
U8	Resistor, Network, 5 k, 1/10 W, 20%	27867
	BCD Output Cable Assembly	BS49009
J4	Connector, PT 02A-20-415	JXXXX
	BCD Output Cable Wire List	AS49008


NOTES: (UNLESS NOTED)
1. ALL CAP. IN μf
2. ALL RES.: ¼ W, 5%





A4, 200MHz AMP & DECADE SCHEMATIC, D39095R4



A4, 200MHz AMP & DECADE ASSEMBLY, D39098R5

A4, 200MHz AMP & DECADE ASSEMBLY, D39098R5